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# ERRATA

Volume xvii page 14 line 43 and xviii page 89 line 3 for '[*Vigna unguiculata*]' read '[*Cajanus cajan*]'

## VOLUME XXI

| | | |
|---|---|---|
| page | 18 line | 1 after 'tests' insert 'on tulips' |
| | 20 | 44 for '*cyntherismae*' read '*syntherismae*' |
| | 42 | 35 for '$2' read '$2.50' |
| | 47 | 11 for '*kuhnii*' read '*kuehnii*' |
| | 47 | 15 for '*Philipp. J. agric.*' read '*Philipp. J. Sci.*' |
| | 63 | 4 for 'Yarwood (E. C.)' read 'Yarwood (C. E.)' |
| | 77 | 47 for '*Aonodiella*' read '*Aonidiella*' |
| | 126 | 33 for '450' read '453' |
| | 203 | 37 for '*rupricaprina*' read '*rupicaprina*' |
| | 233 | 24 for '*Haplographium*' read '*Haplophragmium*' |
| | 243 | 7 for 'grapefruit' read 'wild olive' |
| | 267 | 8 for 'Crouch' read 'Couch' |
| | 289 | 7 for 'xviii, p. 532' read 'xx, p. 202' |
| | 342 | 45 and 48 for '*Achyla*' read '*Achlya*' |
| | 344 | 18 for '*cyclopeum*' read '*cyclopium*' |
| | 351 | 22 for '327' read '324' |
| | 363 | 22 for '[*Cicer arietinum*]' read '[*Cajanus cajan*]' |
| | 366 | 48 for 'Sprague (R. A.)' read 'Sprague (R.)' |
| | 383 | 34 for '*homoeocarpi*' read '*homoeocarpa*' |
| | 452 | 45 for '131' read '130' |
| | 455 | 5 after 'Jenkins (Anna E.)' insert 'Ruehle (G. D.)' |
| | 471 | 18 for '*officinale*' read '*somniferum*' |
| | 542 | 31 for 'Blood (L. H.)' read 'Blood (H. L.)' |

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IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
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VOL. XXI | JANUARY | 1942

PADWICK (G. W.). **Report of the Imperial Mycologist.**—*Sci. Rep. agric. Res. Inst., New Delhi, 1939–40*, pp. 94–101, 1941.

The following are among the items of interest in this report [cf. *R.A.M.*, xix, p. 583]. Tests with wheat varieties for resistance to *Ustilago tritici* [loc. cit.] with a collection of the smut made at Delhi in 1939 suggested that this may be a different physiologic race from that represented by the Pusa collection used in earlier experiments. Of 70 wheat varieties tested against *Urocystis tritici* [loc. cit.], 29 showed no infection, including all those that remained unaffected in previous years.

A fungus closely resembling *Ophiobolus graminis* was isolated from a foot and root rot of wheat new to India found near Pusa. Inoculation tests showed the fungus to be very destructive and to produce symptoms identical with those of take-all. No perithecia were observed.

The *Fusarium* causing gram wilt [*F. orthoceras* var. *ciceri*: ibid., xx, p. 83] was shown to survive well in roots and stems, even apparently healthy ones growing among diseased gram harbouring enough to be parasitic on the next season's crop. Application of farmyard manure hastened the disappearance of the fungus. A species of *Trichoderma* highly antagonistic to the organism in Petri dishes was useless in the soil and an *Aspergillus* which retarded infection was subsequently ineffective. Of 56 gram varieties tested for wilt resistance, the Imperial Pusa Types 9, 28, and 52 were highly susceptible, I.P. 28 was intermediate, and I.P. 22, 63, 69, and 83 showed no infection. I.P. 78 was unaffected in 1939, but had 32 per cent. infection in the season under review.

A species of *Fusarium* quite distinct from *F. orthoceras* var. *ciceri* was isolated from wilted lentil plants at Delhi and Karnal and from certain gram varieties in the latter place. In inoculation experiments it caused wilt of both lentil and gram, though *F. orthoceras* var. *ciceri* infected only gram.

Linseed was found to be infected with *Oidium lini* [cf. ibid., xiii. p. 515], a new record for India.

Of 249 potato varieties and hybrids tested against *Alternaria solani*, 8 were completely resistant and 91 only very mildly affected. *Phytophthora parasitica* was isolated from the leaves and petioles of potato plants at Simla reported to show late blight. It tolerated temperatures

of 33° to 34° C. Infection tests on tubers and leaves gave positive results, and the fungus was reisolated. It readily attacked tomatoes. True late blight at Simla and elsewhere was due to *P. infestans*.

The total number of isolates so far obtained from potato tubers found rotting at the Potato-breeding Sub-station, Simla, amounts to 486, of which 442 are species of *Fusarium*. Two species of *Fusarium* appear to predominate, one represented by 165 and the other by 109 isolates. Inoculations of Darjeeling, Gola, Great Scot, and Phulwa tubers with its different *Fusarium* isolates showed that all infected tubers of the four varieties, two giving 100 per cent. infection on all four.

*P. parasitica* was isolated from brinjal [eggplant] fruits and seedlings.

**Fifteenth Annual Report of the Department of Scientific and Industrial Research, New Zealand, 1940–41.**—92 pp., 2 maps, 1941.

On p. 9 of this report [cf. *R.A.M.*, xix, p. 643] T. R. Vernon states that tests on the storage of cheese [ibid., xiv, p. 443] showed that no mould developed on cheese kept in an insulated room in which the temperature was controlled and the atmospheric humidity maintained at 80 to 85 per cent., while very occasional mould [unspecified] was noted in an uninsulated, uncontrolled room, in which humidity ranged from 50 to 95 per cent., and considerable mould developed in an insulated, uncontrolled room where the humidity varied from 65 to 95 per cent. The results indicate that a new design of storage room should be adopted with insulation, low ceilings, no windows, and automatic temperature and humidity control.

G. H. Cunningham (pp. 23–26) lists among new diseases recorded *Bacterium* [*Xanthomonas*] *pruni* (probably introduced from the United States) on several varieties of Japanese plums, *Beta* virus 2 (Smith) [beet yellows virus] on sugar beet and mangold, an unidentified virus disease of rhubarb, which will probably destroy the Canterbury industry if left unchecked, and carnation ring spot (*Heterosporium echinulatum*) [*Didymellina dianthi*: ibid., xvi, p. 255; xvii, p. 506]; all were introduced with plants or seeds from overseas.

It was ascertained that the fungus causing blind seed disease (*Helotium* sp.) [ibid., xx, p. 263] of rye grass [*Lolium perenne* and *L. multiflorum*] does not perennate within the vegetative tissues of the plant, and slime conidia, after drying, lose their germinative ability within one month. Hence, infection of the new seed crop must arise entirely from ascospores produced by blind seeds shed or sown in the previous autumn. The identity of the endophyte of *L. perenne* [ibid., xix, p. 224; xx, p. 122] remains obscure; microspores morphologically resembling those of *Endoconidium temulentum* were isolated in pure culture, but no other spore stage was observed.

Both tall and meadow fescue [*Festuca elatior* and *F. pratensis*] were observed to be permeated with a seed-borne endophyte resembling the fungus of perennial rye grass. Tall fescue except in one or two parts of Otago and Southland is infected everywhere in New Zealand, but shows no outward sign. The organism was invariably cultured from seeds and stems, and has a conidial stage identical with that of *Epichloe typhina* [ibid., xiv, p. 766].

A strain of *Claviceps purpurea* from Hungarian commercial ergot

(probably from rye) gave heavy infection when a conidial suspension was sprayed on to rye blossoms. When the same strain was used on small field plots, one, two, and three applications yielded, respectively, 115, 140, and 176 lb. of air-dried ergot per acre. The ergot produced, however, was entirely lacking in alkaloids.

Surveys of some 14,000 acres planted to linen-flax showed the presence of browning (*Polyspora lini*) [ibid., xx, pp. 195, 261], rust (*Melampsora lini*) [ibid., xx, pp. 195, 294], wilt (*Fusarium lini*) [ibid., xx, p. 408], foot rot of unknown origin, and 'pasmo' (*Sphaerella linicola*) [*S. linorum*: ibid., xviii, p. 112; xx, p. 18]. *P. lini* was general in Southland, but troublesome only on crops sown in October. It was also found on *Linum monogynum*. *M. lini* was present in most crops in Marlborough and Canterbury, but was not found in Otago or Southland. Very little damage was done to the fibre. The fungus was also found on *L. monogynum*. *F. lini* was found in one crop at Oxford, Canterbury, and three in the Winton district of Southland. *S. linorum* was isolated from plants grown at Owairaka from seed obtained from commercial lines grown at Blenheim. The symptoms of pasmo so closely resembled those due to browning that pasmo may have been mistaken for browning during the survey.

Tests were made under commercial glasshouse conditions with three tomato varieties reputedly immune from leaf mould (*Cladosporium fulvum*) [ibid., xx, p. 246]. Kondine Red was used as a control, duplicate plots of which were sprayed with shirlan AG. The results showed that Kondine unsprayed, Kondine sprayed, one immune variety, and a second immune variety yielded, respectively, 2 lb. 5 oz., 3 lb. 4 oz., 5 lb., and 5 lb. 11 oz. per plant. Selections of one immune variety have been made for commercial seed production.

In a glasshouse experiment in which soil was artificially infected with *Verticillium albo-atrum*, tomatoes in the control plots showed 100 per cent. infection, while those in the soil treated with formalin solution (1 in 50 and 1 in 80) were completely unaffected. It was found necessary to apply the solution at the rate of 50 gals. per 15 sq. yds. soil, as the ground had to be saturated before satisfactory results were secured.

Jonathan apples developed a minor outbreak of bud and blossom rot due to *Fusarium lateritium*. Evidence was obtained confirming the view that *Phoma pomi* [ibid., xvii, p. 465] overwinters on or in apple buds; an application of Bordeaux mixture at the green-tip stage considerably reduces foliage infection in spring.

Strawberry yellow edge [ibid., xx, p. 72 and below, p. 28] and the two forms of crinkle [mild and severe: ibid., xix, p. 717] were found to be transmitted by *Capitophorus potentillae* and not by *Tetranychus telarius*.

Citrus fruits dipped in shirlan WS (0·25, 0·5, and 1 per cent.) showed not more than 6·5 per cent. infection by *Penicillium digitatum*, as against 32 per cent. for the untreated controls.

At the Dominion Laboratory gas storage again completely controlled Jonathan spot of apples [ibid., xix, p. 644]. The use of nitrogen in manurial treatments at the Appleby Research Orchard increased breakdown and fungal infection in Cox's Orange Pippin apples [ibid.,

potash dressings in 1933 and 1934 still showed greatly reduced breakdown and fungal infection, but more wilt, and rather more slight Jonathan spot. Phosphate applications again reduced breakdown incidence in Sturmer apples, and did not appreciably increase wilt. Nitrogen with and without phosphate induced a sharp rise in the amount of breakdown and a small reduction in the amount of wilt.

RICHARDSON (A. S.). **Report of the Director of Agriculture.**—*Rep. Dep. Agric. Nyasald, 1940*, pp. 5–20, 1941.

In this report [cf. *R.A.M.*, xx, p. 113] it is stated (p. 10) that during 1940 the cotton crop in Nyasaland remained very largely free from angular leaf spot (*Bacterium* [*Xanthomonas*] *malvacearum*) and direct bacterial lesions on the bolls, staining being found to be due to *Nematospora gossypii*. Groundnut rosette was serious throughout the Protectorate. A species of *Dothiorella*, possibly *D.* [*Botryosphaeria*] *ribis*, was associated with a branch and twig canker of tung oil trees (*Aleurites* spp.) on a number of estates [cf. ibid., xv, p. 514] and a stem canker appeared to be caused by *Fusarium lateritium*.

MILBRATH (D. G.). **Bureau of Plant Pathology.**—ex *Rep. Calif. Dep. Agric. 1940* (*Bull. Dep. Agric. Calif.*, xxix, 4), pp. 268–282, 1940.

In this report [cf. *R.A.M.*, xix, p. 692] it is stated that during 1940, 4,720 new cases of peach mosaic were found in California; by the end of the year only 354 remained, after a concerted eradication effort.

The control of western celery mosaic [ibid., xx, p. 346] by an enforced celery-free period was continued in three separate areas. In the Venice-Culver City district the yield per acre in 1940 amounted to 1,000 half-crates, as against 1,100 in 1939. The slight decrease was due to adverse weather conditions. The causal organism of chestnut blight [*Endothia parasitica*: ibid., xvii, p. 798] appears to be spread by rain and irrigation water.

Pierce's disease of grapes [ibid., xix, p. 693] became more widely distributed and spread rapidly in individual vineyards; it causes rapid decline and death on most commercial varieties in one to three years. The area most affected has been the source of much propagation stock.

To assist growers to obtain seed free from bacterial ring rot [*Bacterium sepedonicum*: ibid., xx, p. 562], which was again general in potatoes grown in California and other States, arrangements were made for seed-testing, field inspection, and close co-operation with the Seed Potato Certification Service. Control lies in building up a healthy foundation stock by seed-growers.

Cantaloupe melons in the Imperial Valley were affected more severely than for some years past by powdery mildew [*Erysiphe cichoracearum*: ibid., xix, p. 578]. The variety selected and bred for resistance failed to produce disease-free vines. Either a new strain of the fungus may have been present, or a suppressed strain had become active again. In breeding work for resistance the participation of growers had to be obtained, because of the absence of a seed stock of commercially desirable cantaloupes as resistant as Cantaloupe No. 45 had been to the strain formerly prevalent.

Watermelons in the Imperial Valley developed very severe mosaic

[ibid., xiii, p. 146]. More than one virus appeared to be involved. Plants infected in the early stages of growth either produce no melons or distorted, unmarketable fruit. The symptoms vary greatly: on some vines the fruits are misshapen and mottled, while on others they remain normal, though the leaves are mottled. There exists a reservoir of virus material in volunteer melon vines, wild cucurbits, and viruliferous insects.

New and uncommon diseases included *Phytomonas* [*Xanthomonas*] *begoniae* on *Begonia* and *Physalospora cydoniae* on *Pyrus* sp.

Godfrey (G. H.). **Noteworthy diseases of economic crops and native plants in Lower Rio Grande Valley in the spring of 1941.**—*Plant Dis. Reptr*, xxv, 13, pp. 347–353, 1941. [Mimeographed.]

This report includes, among others, the following items of interest. Slight damage was caused in a small pepper [*Capsicum annuum*] seedbed at the Lower Rio Grande Valley Experiment Station, Weslaco, Texas, by *Peronospora tabacina*, but the outbreak was checked by a single dusting with red copper oxide, and there was no recurrence. *Nicotiana repanda*, a native wild tobacco growing profusely as a weed, was frequently found to be infected by *P. tabacina* and the same disease was also present in the Robstown area, 150 miles north of the Valley. This first record of *P. tabacina* from Texas indicates that the area concerned may have been one step in the possible migration of the fungus from southern California to the tobacco sections of the south-eastern States [cf. *R.A.M.*, xiii, p. 602]. Flax, including the Argentine varieties, was attacked extensively in the field by *Sphaerella linorum* [see above, p. 3].

Fawcett (G. L.). **Departamento de Botánica y Fitopatología.** *Ex* **Memoria anual del año 1940.** [Department of Botany and Phytopathology. *Ex* Annual Report for the year 1940.]—*Rev. industr. agríc. Tucumán*, xxxi, 1–3, pp. 47–50, 1 fig., 1941.

The following items of interest are included in this report [cf. *R.A.M.*, xx, p. 105]. During 1940 sugar-cane in Tucumán was attacked by a fungus not hitherto reported from the Argentine, viz., *Ustilago* (?) *sacchari* [*U.* (?) *scitaminea*], the damage caused by which has so far not been extensive.

A species of *Pythium* has been isolated from the decayed roots of chick peas [*Cicer arietinum*] in the Trancas district, where gaps in the stand due to an as yet unexplained disease occur annually in the same spots. A *Rhizoctonia* is responsible for similar injury to this crop under humid conditions.

In addition to 'corcova' [hunchback: ibid., xx, p. 501], *Septoria lycopersici* was prevalent in the tomato crops. Bordeaux mixture, applied in good time, affords certain protection against the disease, which is usually overlooked, however, until the leaves have fallen. Experiments in spraying with lime alone (1 to 2 in 100) gave promising results, the drawback to this method being the need for repeated

WHITE (P. R.) & BRAUN (A. C.). **Crown gall production by bacteria-free tumor tissues.**—*Science*, N.S., xciv, 2436, pp. 239–241, 1941.

Tissue fragments from the interior of a series of secondary tumours caused by *Phytomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xx, p. 198] were removed aseptically [? from sunflower plants] and inserted in 125 ml. Erlenmeyer flasks containing 50 ml. of White's standard glycine-thiamin nutrient stiffened with 0·6 per cent. of well-leached agar. Of 37 isolations from large secondary tumours from the stems at nodes 19 grew. Six isolations were carried through three or more passages, being divided at each passage, and one strain through 13 successive passages, theoretically increasing in volume approximately 450,000 times. Of the 482 cultures none developed any bacterial growth and attempts to isolate bacteria consistently failed. When the cultures were triturated and the paste was injected into sunflower or tomato plants, no galls developed, though they constantly appeared when paste from young primary tumours was injected. These results appear to establish the capacity of these tissues for autonomous growth.

Cultures of cambial and procambial tissues from healthy sunflowers were maintained for nine weeks and carried through five passages, but the volume increase was only about 30 times.

After five successive passages *in vitro* 10 tumour cultures were grafted back into young, healthy sunflower plants. After 7 weeks 5 implants had grown into typical crown gall tumours up to 1 cm. in diameter. Similar results were obtained with cultures from the sixth and tenth passages. Attempts to isolate bacteria from one tumour by grinding and plating failed. These results indicate that gall tissues differ from normal tissues in their capacity to produce galls and by their behaviour *in vitro*. These characteristics are clearly induced by some stimulus from *Bact. tumefaciens*, but are not dependent upon the continued presence of the bacteria.

GARCÉS (C.). **Informe sobre la situación patológica de los Cacaotales en los Departamentos de Valle y Cauca.** [Memorandum respecting the pathological status of the Cacao plantations in the Valle and Cauca Departments.]—*Rev. Fac. nac. Agron. Colombia*, iv, 12, pp. 1280–1300, 1941.

The following cacao diseases were observed by the author during a tour in 1939 through the Departments of Valle and Cauca, Colombia, the plantations of the former comprising some 3,600,000 and those of the latter 2,000,000 trees in production. Root rots occur throughout the area visited, but their symptomatology is confused and their etiology obscure.

*Phytophthora faberi* [*P. palmivora*] is responsible for heavy damage, affecting a minimum of 90 per cent. of the trees in some plantations and producing cankers up to 2 m. in length; in other cases the trunks bore up to five lesions over a length of 1 m., bringing production to a standstill through progressive debility. Infection of the pods in rainy seasons may involve losses of 40 per cent. of the crop.

*Corticium salmonicolor* is of little importance except in the Digua Valley, where the extremely humid conditions are more conducive to the development of the pathogen than those prevailing in Calle and Cauca.

'Die-back', like 'root rot', is a generic term for a group of disorders of varying origin, characterized essentially by progressive desiccation from the top downwards and favoured by such factors as drought, excessive humidity, bad drainage and poverty of the soil, exposure to wind, insufficient shade, cortical injuries from agricultural implements, and the like.

*Bacterium tumefaciens* is believed to be the agent of incipient hypertrophy of the floral cushion, of no importance at the moment in the districts under observation but causing heavy damage elsewhere in the country (Department of Antioquia) by the suppression of pod formation.

The agent of brown rot (*Diplodia*) [? *cacaoicola* = *Botryodiplodia theobromae*: *R.A.M.*, xviii, p. 12] is a weak parasite of ripe pods bearing wounds or scarifications of diverse origin, on which it produces symptoms very similar to those of *P. palmivora*.

*Monilia* or swamp disease [? *M. roreri*: ibid., xvii, p. 801] is stated to be assuming an alarmingly grave character in the two Departments visited, causing losses exceeding 90 per cent. of the crop.

Anthracnose (*Colletotrichum*) [ibid., xviii, p. 12] is fairly widespread but unimportant, except in the rare cases in which it penetrates to the seed, causing blackening and death.

One of the author's principal objectives was to investigate the suspected occurrence of witches' broom [*Marasmius perniciosus*] in the Valle and Cauca plantations, where this much dreaded fungus, however, does not seem to be present, the so-called 'palm' disease being distinguishable as follows. The chupons are in both cases abnormally slender, but in 'palm' disease they are not branched, as in witches' broom, and they persist for more than six months, the maximum period of retention in trees attacked by *M. perniciosus*. The leaves of 'palm'-diseased plants are of normal size and turgid, in contrast to the dwarfed, flaccid foliage of witches' broom, while in the former disease the flowers are likewise normal, whereas in the latter they are abortive and stellate. Pods on 'palm'-diseased trees show none of the malformations, blackened areas, or hard places associated with witches' broom. Finally, on no occasion were old brooms, bearing the sporophores of the fungus, present in 'palm'-diseased trees. Another spurious form of witches' broom has been reported in the above-mentioned Digua Valley, where some 20,000 cacao trees are in cultivation, largely of the Antillano variety. The malady in question originated on the estate of a German grower, who termed it 'witches' broom' from the descriptions given in German text-books of a condition attributed to this cause in the Cameroons and certain English possessions, but actually distinct from the Surinam disease. The affected trees in the Digua Valley bear chupons attaining a length of up to 2·80 m., generally almost destitute of leaves and branching irregularly, the short branches with slender bases turning over and producing, usually unilaterally, a series of twigs which undergo rapid lignification and decay at the tips, such foliage as develops being dark green and stunted. Notwithstanding the slow progress of this disease and its relatively innocuous character at the moment, precautions should be taken to exclude it from the Valle and Cauca plantations by prohibiting the use of Digua seed, since the trouble may well assume a more serious aspect. The

principal shade trees grown in Colombian cacao plantations are *Erythrina* (?) *glauca* and *E.* (?) *poepigiana*, of which the former suffers from (*a*) bark rot associated, *inter alia*, with *Pleurotus*, *Polystictus*, and *Ganoderma* spp., but possibly of bacterial origin, and characterized by necrotic, malodorous lesions, up to 20 by 10 to 15 cm., causing gradual detachment of the cortex from the woody cylinder, desiccation, and total defoliation; and (*b*) the rust *Dicheirinia binata* (Berk.) Brth., producing on the young leaves and shoots pustules and large swellings which result in the shedding of the foliage: the latter is affected by leaf spots of no immediate importance due to *Cercospora erythrinae* and *Metasphaeria* sp.

Miles (L. E.). **Downy mildew on Oats in Mississippi.**—Abs. in *Phytopathology*, xxxi, 8, p. 768, 1941.

In the late spring of 1939 *Sclerospora macrospora* [*R.A.M.*, xiii, p. 804] was observed in Sunflower County, Mississippi, and in 1940 four more counties were found to be involved, in one of which a few volunteer wheat plants also showed infection. This is stated to be the first record of downy mildew on oats in the United States, and the first report of its occurrence on wheat in Mississippi. Diseased plants assume a stiff habit of growth, the leaves being abnormally fleshy and erect. No viable seed is produced, and the fruiting panicles are often much distorted. The rachis and rachilla become contorted, and the spikelets produce a single seed-like structure in the glumes in place of the normal two seeds in close contact. The diameter of the oospores (the only sexual organs present) was found to agree fairly closely with that of specimens from cereals, rice, and wild grasses from various parts of the United States, Italy, Japan, and Australia, though all the Japanese collections and one on *Avena fatua* from New South Wales averaged much smaller.

Coffman (F. A.), Humphrey (H. B.), & Murphy (H. C.). **New Red Oats for fall seeding resistant to rusts and smuts.**—*J. Amer. Soc. Agron.*, xxxiii, 10, pp. 872–882, 1 fig., 1941.

In addition to the three varieties of red oats already released for distribution and combining resistance to smuts [*Ustilago avenae* and *U. kolleri*] and crown rust [*Puccinia coronata*] with other desirable qualities, viz., Fultex, Ranger, and Rustler [*R.A.M.*, xx, p. 357], it is stated that in several selections from crosses involving Richland, Victoria, and Red Rust-proof, the stem rust [*P. graminis*] resistance of the first-named, the crown rust and smut resistance of the second, and the winter hardiness and other acceptable characters of the third have been successfully combined. Preliminary observations further indicate that certain segregates of other crosses may prove well adapted to autumn sowing in the extreme south of the United States.

Fomin (E. E.) & Nemlienko (F. E.). 'Черный зародыш' семян хлебных злаков. ['Black radicle' of cereal seed-grain.]—*Селекция и семеноводство* [*Selection and Seed-growing*], *1940*, 10, pp. 30–32, 3 figs., 1940.

A 'black radicle' [? = black point] disease of cereals is reported

from the Ukraine, causing considerably reduced stands of barley and spring wheat and, in a lesser degree, of winter wheat and oats. In experiments with spring wheat there was a reduction in emergence of 27 per cent. The tips of diseased grains, round the radicle, were black or brown; the seed either failed to germinate or more often produced weak and stunted seedlings, the underground parts of which showed interrupted yellow-brownish streaks, while the roots were poorly developed. An analysis of 132 samples of cereal seed from various farms showed in some cases 40 per cent. infected grains. Barley and spring wheat with 11 to 32 per cent. infection gave 55 to 82 per cent. emergence and barley with 32 to 36 per cent. infection 75 to 84 per cent. emergence. The disease is stated to be due to a number of factors and to be caused by various micro-organisms, chiefly *Helminthosporium sativum* and an undetermined species of *Alternaria*. In samples of diseased grain 28·5 to 94·8 per cent. were infected by *H. sativum*, 5·2 to 64·3 per cent. by *Alternaria* sp., and 0·0 to 13·6 per cent. by unidentified bacteria and fungi. In grain infected by *H. sativum* the blackening often expanded from the radicle to other parts of the seed, which usually became somewhat shrivelled; the mycelium of the fungus permeated the tissues of the pericarp, endosperm, and the radicle, and penetrated, after emergence of the seedling, into the stem and root, but not beyond a distance of 10 cm. from the seed. In grain infected by *Alternaria* sp., the blackening was usually restricted to the area around the radicle, the seed remained unshrivelled, and the mycelium of the fungus was found only in the pericarp and very rarely in the endosperm. The external symptoms produced by the two pathogens, however, varied considerably and rendered differentiation difficult except by culturing. In trials with spring and winter wheats some varieties showed only negligible infection and are considered promising for breeding work. In control experiments soaking the seed in a 0·1 per cent. solution of mercuric chloride for 5 minutes reduced infection to 3·1 per cent. and thermal disinfection (soaking for 4 hours at 30° C. and then heating for 8 minutes at 52°) to 30 per cent. Mercuric compounds are, however, considered too highly toxic for practical use and thermal disinfection is recommended. Further measures of control should include regular weeding of wild grass hosts, immediate drying of moist seeds after harvest, prompt removal of harvested cereals from the field, deep ploughing, and agrotechnical methods to ensure a vigorous development of the plants.

Soukhoff (K. S.). 'Закукливание 'злаков. ['Pupation' of cereal crops.] —*Селекция и семеноводство.* [*Selection and Seed-growing*], *1940*, 11–12, pp. 30–33, 3 figs., 1940.

This is an up-to-date summary of results and conclusions regarding the epidemiology and the nature of the pupation disease of cereal crops in Siberia [*R.A.M.*, xx, p. 155], on the basis of which the following recommendations are given for control: (1) ploughing in the stubble of late oats and millet [*Panicum miliaceum*] directly after harvest and ploughing a surrounding strip of ground, in order to starve the larvae of the vector; (2) healthy seed should be sown densely to ensure good stands, which are unfavourable for epidemics of the

disease; and (3) fallow land should be kept clear of weeds in which the virus could survive for long periods.

Gadd (I.) & Kjaer (A.). **Über die Verwendbarkeit der Selen- und Indigokarminmethoden bei der Prüfung von Frost- und Fusarium-geschädigtem Getreide.** [On the applicability of the selenite and indigo-carmine methods to the testing of frost- and *Fusarium*-damaged cereal seed-grain.]—*Proc. int. Seed Test. Ass.*, xii, 2, pp. 140–149, 1940. [English summary.]

In the writers' dual staining method cereal (wheat, barley, and oats) seeds (400 per sample), cut lengthways, were placed after 24 hours' pre-soaking in a mixture of equal parts of a 1 per cent. solution of sodium biselenite and 0·25 per cent. indigo-carmine, in which they were left for another 24 hours. By the end of this time the live tissues of the cut embryo surfaces had assumed a red, and the dead ones a blue, tinge. In the case of primary infection by *Fusarium* the embryos are dead, whereas secondary infection involves only the glumes and outer cell layer of the caryopsis, leaving the embryo alive. In such samples, however, the coleoptile and roots will give rise to abnormal seedlings, and therefore the germination values forecast on the basis of the selenite staining method are apt to be too high, the same being true of frost-damaged material. In laboratory tests of the germinating capacity of damaged samples only quite normal sprouts should be counted.

Leukel (R. W.) & Nelson (O. A.). **The use of chlorine gas as a seed disinfectant.**—*Circ. U.S. Dep. Agric.* 576, 16 pp., 1 diag., 1940.

A detailed, tabulated account is given of a series of laboratory and commercial trials at the Arlington Experiment Farm, Virginia, on the efficacy of chlorine gas as a cereal seed-grain disinfectant [*R.A.M.*, xix, p. 75]. Bunt (*Tilletia* spp.) [*T. caries* and *T. foetida*] in Baart and Purplestraw wheat was adequately controlled by two hours' exposure of the seed-grain to chlorine concentrations of 3 to 9 per cent., while one hour at 10 per cent. sufficed to eliminate covered smut of Chiltex sorghum (*Sphacelotheca sorghi*). Oats and barley smuts (*Ustilago levis* [*U. kolleri*] and *U. hordei*) were not appreciably affected by the treatment, irrespective of the gas concentration or length of exposure. In order to secure satisfactory destruction of surface-borne smut spores without injury to the seed-grain, the volume of gas should not be less than 20 or more than 40 per cent. of the net volume of the seed.

Nieschlag (F.). **Über die Wirkung der schwefelsauren Salze des Kupfers, des Mangans, des Magnesiums, des Eisens, des Aluminiums, und des Kalks auf heidemoorkranken Böden.** [On the effect of the sulphates of copper, manganese, magnesium, iron, aluminium, and lime on reclamation disease-producing soils.]—*Bodenk. u. PflErnähr.*, N.F., xxiii, 5–6, pp. 350–356, 1941.

A tabulated account is given of experiments covering the period from 1936 to 1940 at the Oldenburg Agricultural Research Station on the response of black oats (1936 and 1940) and winter rye (1937, 1938, and 1939) to treatments of two types of soil (sand with a rich admixture of

humus and pulverized moorland) with copper, manganese, magnesium, iron, aluminium, and calcium sulphates at the rates of 50 and 100 kg. per ha., potash, alum, and gypsum also being included in some of the tests. The crops responded favourably not only to copper sulphate [*R.A.M.*, xx, p. 351], but also to the iron, aluminium, manganese, magnesium, and calcium treatments, the average increases in the grain yields for the five-year period, reckoned in doppelzentner [100 kg.] per ha., being $5{\cdot}37 \pm 0{\cdot}89$, $1{\cdot}76 \pm 0{\cdot}80$, $4{\cdot}39 \pm 0{\cdot}82$, $1{\cdot}73 \pm 0{\cdot}96$, $4{\cdot}28 \pm 0{\cdot}75$, and $2{\cdot}66 \pm 1{\cdot}00$, respectively. It is pointed out, however, that a specific remedial effect on the disease can be ascribed only to copper sulphate. The stimulating effect of magnesium on the yield is attributed to the correction by the treatment of the deficiency of this element in the soil, and that of iron and manganese to an indirect influence in the form of assistance in the assimilation of copper; the beneficial action of aluminium is not easy to interpret, but it may be connected with a favourable exchange with the silicic acid content of the soil. The reason for the large increases of grain yield obtained in the alum-treated plots, averaging (in dz. per ha.) $4{\cdot}64 \pm 3{\cdot}43$ and $3{\cdot}34 \pm 2{\cdot}57$ for the half and full rates of application, respectively, for oats and $4{\cdot}49 \pm 1{\cdot}52$ and $4{\cdot}69 \pm 0{\cdot}93$, respectively, for rye, is also obscure. Gypsum tended to stimulate the grain yields on the acid ($P_H$ 4·5) sandy soil. There is some reason to believe that the sulphate ions modify the soil humus in such a way as to afford better conditions for the growth of the crops.

WINTER (A. G.). **Die Infektion des Weizens durch Ophiobolus graminis als Funktion der Temperatur.** [The infection of Wheat by *Ophiobolus graminis* as a function of temperature.]—*Z. PflKrankh.*, l, pp. 444–459, 1940. [Abs. in *Zbl. Bakt.*, Abt. 2, ciii, 21–24, p. 413, 1941.]

In inoculation experiments with *Ophiobolus graminis* on wheat [*R.A.M.*, xix, p. 465] at 10°, 16°, and 22° C. the incidence of infection in sterilized humus soil increased parallel with rising temperatures. In soils with a low humus content the influence of temperatures below 16° was weaker and above this point stronger than in those with an abundance of humus. In non-sterilized soils the incidence of infection even at the higher temperatures was less than in a sterilized medium, due to the presence in the former of antagonistic micro-organisms and the more rapid disintegration of the inoculum. The influence of soil moisture increases with the approximation of the temperature to the optimum.

FISCHER (G. W.) & HOLTON (C. S.). **Inheritance of sorus characters in hybrids between Ustilago avenae and U. perennans.**—*Mycologia*, xxxiii, 5, pp. 555–567, 3 figs., 1941.

In successful hybridization experiments in the United States crosses between *Ustilago avenae* and *U. perennans* [*R.A.M.*, xx, p. 526] were made which involved four sorus characters. The naked and powdery characters were found to be dominant over covered and indurate, respectively. Independent inheritance of these characters was indicated by the production in the $F_2$ generation of naked powdery, naked indurate, covered powdery, and covered indurate segregates. In the

$F_3$ generation the naked powdery segregate gave rise to all four of the above-mentioned types of segregates; the naked indurate segregate produced the naked indurate and covered indurate types; the covered powdery segregate gave covered powdery and covered indurate types; and the covered indurate segregate yielded only the covered indurate type of sorus. In crosses of *U. perennans* with a race of *U. avenae* having normal powdery sori, the naked sorus character was again dominant over the covered sorus character. Cultivated oats were susceptible to *U. perennans*, but tall oatgrass (*Arrhenatherum elatius*) [*A. avenaceum*] was resistant to both *U. avenae* and the hybrids between the two smuts. The two species of smut are considered to be synonymous by virtue of the morphological identity of their chlamydospores, their genetic relationship, and host range. The name *U. avenae* is recognized for the consolidated species, while *U. perennans* is considered to be a race of the former.

Robbins (W. J.) & Ma (Roberta). **Biotin and the growth of Fusarium avenaceum.**—*Bull. Torrey bot. Cl.*, lxviii, 7, pp. 446–462, 6 figs., 1941.

A strain of *Fusarium avenaceum* supplied by E. R. Vitoria from the Argentine failed to grow in a mineral-sugar solution which constituted a satisfactory medium for two other isolates of the same fungus from the United States. The first-named strain developed rapidly when the original substratum was enriched with 1·5 per cent. purified Difco agar, the beneficial effect of which is attributed in part to its biotin content [cf. *R.A.M.*, xviii, p. 542], amounting in some samples to as much as 0·1 mg. per gm., while other unidentified growth substances are also believed to be concerned in the improved growth of the organism. All or nearly all the biotin was removed from the agar by extraction with aqueous pyridin.

Nemlienko (F. E.). Экологические факторы и пузырчатая головня Кукурузы. [Ecological factors and blister smut of Maize.]—*C.R. Pan-Sov. V. I. Lenin Acad. agric. Sci., Moscow, 1941*, 5, pp. 39–41, 1941.

Meteorological data collected over four years (1932 to 1935) in the Ukraine showed that in the first two years when the precipitation was greater by 100 mm., and the air and soil humidities higher by 15·5 and 5 per cent., respectively, than in the following two, the percentage of blister smut of maize [*Ustilago zeae*: *R.A.M.*, xvi, p. 36] was much lower (8·4 to 8·6 per cent. as against 17·7 to 20·2 per cent.). Similarly, in 1934, the disease was found to be more prevalent in dry districts (16·1 per cent.) than in more humid ones (0·7 per cent.), the corresponding figures for 1933 being 9·3 and 0·3 per cent. These data are explained on the basis of an increased susceptibility of plants suffering from lack of water.

Bliss (D. E.). **Artificial inoculation of plants with Armillaria mellea.**—Abs. in *Phytopathology*, xxxi, 9, p. 859, 1941.

Infection of healthy citrus roots by *Armillaria mellea* was obtained only with pure cultures of the fungus on the wood of the host, those

on nutrient agar and bran, as well as detached rhizomorphs, being non-pathogenic. The rhizomorphs developed in soils of widely differing types and reactions, e.g., peat at $P_H 4$ and sand at $P_H 8$. Rotted, non-sterile manure was penetrated, but apparently not utilized as a source of food. Within a year the rhizomorphs grew to a depth of 67 cm. in sterile glucose-potato agar, but on the exclusion of air from the surface their development was instantly arrested and death ensued. *Trichoderma lignorum* [*T. viride*: cf. *R.A.M.*, xx, p. 508] suppressed the growth of *A. mellea* on agar, but failed to destroy the organism in wood after the formation of a pseudo-sclerotium. The California pepper tree (*Schinus molle*) contracted infection after 71 days in comparatively moist soil at 20° C.

**Diphenyl-treated Orange wrappers.**—*Chem. Tr. J.*, cix, 2833, p. 114, 1941.

The experiments initiated some five years ago by A. Farkas, of the Hebrew University, Jerusalem, on the use of diphenyl-treated wrappers for the prevention of decay in oranges during transit [*R.A.M.*, xix, p. 87] are stated to have been continued since the outbreak of the war. In the 1938–9 season spoilage in a test shipment of Palestine fruit wrapped in impregnated paper amounted to only 0·33 per cent. compared with 4·4 in a corresponding lot for which ordinary paper was used, and similar data were obtained in large-scale trials in 1939–40, when nearly 90,000 cases of oranges were exported from Palestine in treated wrappers.

Special importance attaches to these results at the present juncture, when transport to Europe is liable to abnormal delays. The new treatment has also proved satisfactory in South Africa, California, Cyprus, and Australia. Official tests conducted on behalf of the Minister of Agriculture, New South Wales, showed the incidence of rot in oranges to be significantly reduced by the use of impregnated paper without any sacrifice of appearance, aroma, or flavour, while the chemical has been proved to be completely innocuous at concentrations several times the strength of those to which workers are exposed in the manufacture or employment of the wrappers.

Bliss (D. E.). **A new species of Ceratostomella on the Date Palm.**—*Mycologia*, xxxiii, 5, pp. 468–482, 9 figs., 3 graphs, 1941.

From the roots and trunk of date palms affected by the disease known as wilting or sudden death in the Coachella Valley of California a new species of *Ceratostomella* has been isolated and is named *C. radicicola* [*R.A.M.*, xvi, p. 314]. The flask-shaped, solitary perithecia comprise a faintly coloured, nearly spherical bulb, 180 to 320 $\mu$ in diameter, partially or completely submerged, with none to many, dark, variously branched appendages, 35 to 90 $\mu$ long, and a dark beak, becoming hyaline and fimbriate at the apex, tapering, 440 to 980 $\mu$ long, 24 to 71 $\mu$ in diameter; the asci are deliquescent and the hyaline, elliptical, unequally convex-sided, continuous ascospores, 8 to 15 by 2·5 to 4 $\mu$ in diameter, are found in groups of eight or less. The species is heterothallic, and has an imperfect stage, a *Chalaropsis*, with erect, vase-shaped, uni- to triseptate endoconidiophores, 100 to 190 by 7 to

10 $\mu$, forming at the tip continuous, hyaline endoconidia, variable in size, mostly 8 to 15 by 6 to 10 $\mu$, cylindrical with flattened or rounded ends often collecting in slimy masses; macroconidia develop on procumbent conidiophores with sympodial branching and are hyaline, then dark brown, thick-walled, continuous, ovate to ovoid with a flattened base, mostly 15 to 22 by 11 to 16 $\mu$, borne singly on short hyphae maturing in acropetal succession. In pure culture the colonies of *Ceratostomella radicicola* varied from light grey to black, with a dense growth on glucose-potato agar and a comparatively sparse one on maize meal agar. New colonies developed rapidly under favourable conditions and young endosporophores were produced within a few hours from the time of spore germination, macrospores appearing only a little later. Perithecia were obtained only on artificial media. Attempts to infect date palms with *C. radicicola* gave definite evidence of pathogenicity. The species differs from *C. thielavioides* in its more rapid growth on maize meal agar, its abundant production of macrospores, its wide temperature range, and statistically significant differences in length and width of the endospores and macrospores..

MILLER (P. R.) & WEINDLING (R.). **A survey of Cotton seedling diseases in 1941 and the fungi associated with them.**—*Plant Dis. Reptr*, xxv, 14, pp. 378–380, 1 map, 1941. [Mimeographed.]

During 1941, the fourth consecutive year of the cotton seedling disease survey [*R.A.M.*, xx, p. 14], *Glomerella gossypii*, once more the predominant pathogen, extended its range slightly to the westward of previous locations in Texas and Oklahoma [ibid., xx, p. 113]. *Rhizoctonia* [*Corticium*] *solani* was more generally prevalent than during the past three seasons, the total percentages of *G. gossypii*, *Fusarium moniliforme* [*Gibberella fujikuroi*], *C. solani*, *F.* spp., *Alternaria* spp., *Diplodia gossypina*, and unidentified organisms in the 12 States covered by the survey being 36·4, 39·4, 2·8, 6·3, 0·8, 0·1, and 7·4, respectively.

MARCHIONATTO (J. B.). **Las especies de Septobasidium en la Argentina.** [Species of *Septobasidium* in the Argentine.]—*Darwiniana, B. Aires*, v, pp. 248–263, 4 pl. (2 col.), 3 figs., 1941.

This is an annotated list of the ten species and one variety of *Septobasidium* at present known in the Argentine [cf. *R.A.M.*, xviii, p. 521], including four species and one variety new to that country, and two species new to science, *S. guaraniticum* and *S. caveniae* parasitic on scale insects on *Citrus* spp. and *Acacia cavenia*, respectively.

PETCH (T.). **An Empusa on a Mite.**—*Proc. Linn. Soc. N.S.W.*, lxv, 3–4, pp. 259–260, 1940.

The author received from Mr. K. R. Norris specimens of the mite *Halotydeus destructor* killed (in Western Australia) by a species of *Empusa* with short, stout, unbranched conidiophores, and oval or subglobose primary conidia measuring, respectively, 9 to 12 by 5 to 7 and 8 by 6 $\mu$, in each case with a broad, truncato-convex papilla. The secondary conidia were similar, and borne on a stout germ-tube from any part of the primary conidium, but usually laterally. The fungus is named *E. acarida* n.sp.

Petch (T.). **Myrophagus ucrainicus (Wize) Sparrow. A fungus new to Britain.**—Reprinted from *Naturalist, Lond.*, p. 68, 1st March, 1940.

The author states that the fungus described by him (*Trans. Brit. mycol. Soc.*, xxiii, p. 127, 1939) as *Entomophthora* (*Tarichium*) *reticulata*, and found in September, 1934, at Ingleborough, Yorkshire, in a Dipterous pupa, is the same as *Myrophagus ucrainicus* (Wize) Sparrow (Chytridiaceae). It has not previously been recorded for England.

Schaefer (E. E.). **A fungus of the family Entomophthoraceae found on Sugar Ants (Campanotus sp.).**—*Bothalia*, iv, 1, pp. 237–249, 7 pl., 1941.

Early in 1939 sugar ants (*Campanotus* sp.) in Pretoria, both living and dead, were found to show a fungal growth on the abdominal parts, identified as spores and mycelium of a strain of *Entomophthora coronata* [*R.A.M.*, xvi, p. 745]. Attempts to infect the same species of ants experimentally were unsuccessful, but the larvae all died within two days after being placed on the cultures, and were found to be full of hyphal bodies which, on new medium, gave rise to normal mycelium. The fungus was also ascertained experimentally to attack termites.

Drechsler (C.). **Some Hyphomycetes parasitic on free-living terricolous Nematodes.**—*Phytopathology*, xxxi, 9, pp. 773–802, 7 figs., 1941.

Detailed technical descriptions, accompanied by critical observations on the taxonomic and cultural features of the organisms concerned, are given of the following new species (and one new genus, *Nematoctonus*) of Hyphomycetes preying on various kinds of nematodes in leaf mould and plant debris in Maryland, Virginia, and Wisconsin: *N. tylosporus*, *N. leiosporus*, *Acrostalagmus bactrosporus*, *A. obovatus*, *Cephalosporium balanoides*, *Spicaria coccospora*, *Meria coniospora*, *Harposporium helicoides*, *H. oxycoracum*, and *H. diceraeum*.

Penta (A. Q.). **Fungous diseases of the lungs.**—*Dis. Chest*, vii, 9, pp. 292–304, 22 figs., 1941.

In the course of this survey of recent outstanding contributions to the study of fungous diseases of the lungs, associated, *inter alia*, with *Monilia* [*Candida*] *albicans*, *Torula histolytica* [*Debaryomyces neoformans*], *Blastomyces* [?*Endomyces dermatitidis*], *Coccidioides immitis*, *Sporotrichum schenckii* and *S. beurmanni*, *Aspergillus fumigatus*, *A. flavus*, and *A. niger*, and *Actinomyces bovis*, the writer points out the danger of delayed diagnosis in cases of this kind, involving a very high mortality rate. Practical directions are given for the diagnosis [*R.A.M.*, xx, p. 15] and treatment of the diseases in question.

Waldbott (G. L.), Blair (K. E.), & Ackley (A. B.). **An evaluation of the importance of fungi in respiratory allergy.**—*J. Lab. clin. Med.*, xxvi, 10, pp. 1593–1599, 3 graphs, 1941.

With the 13 genera of fungi most frequently encountered during the last three years in a survey of the air at different heights and in various habitats in the city of Detroit, Michigan [*R.A.M.*, xx, p. 166],

intradermal skin tests were performed on 841 patients with upper respiratory allergy, of whom 580 (69 per cent.) responded positively to one or more of the organisms. *Alternaria*, *Monilia* [*Candida*], *Epidermophyton*, and rust [*Puccinia*] predominated slightly over the other fungi in skin reactivity, *Torula* and *Rhizopus* being the weakest in this respect. Of 442 cultures from nasal and bronchial secretions on potato dextrose agar ($P_H$ 5·5), 274 gave rise to fungi, *Penicillium* leading with 122, followed by *Alternaria*, *Candida*, and yeast with 62, 48, and 42, respectively. The heaviest growths were made in October and November; *Hormodendrum*, *Alternaria*, and *Aspergillus* were present only during the period from July to November. The implication of a single fungus in the etiology of respiratory allergy appeared to be extremely rare. Measured by the standard of skin reactivity, fungi share an approximately equal importance with foods, but are of much less significance than epidermals and pollen, and they mostly occur as complicating factors in multiple-sensitive patients with asthma and vasomotor rhinitis.

GASTINEAU (F. M.), SPOLYAR (L. W.), & HAYNES (EDITH). **Sporotrichosis: report of six cases among florists.**—*J. Amer. med. Ass.*, cxvii, 13, pp. 1074–1077, 3 figs., 1941.

*Sporotrichum schenckii* was isolated from lesions on the arms and hands of six florists in central Indiana, all of whom are believed to have contracted the infection from a common source, viz., sphagnum moss. C. W. Emmons isolated the fungus from one of the samples of this material submitted for examination to the United States Public Health Service.

ELLIKER (P. R.). **Factors influencing mold mycelia in cream.**—*Nat. Butt. Cheese J.*, xxxii, 7, pp. 8–9, 44, 46, 48, 49, 1941.

The following have been shown by the author's observations and experiments at the Department of Dairy Husbandry, Purdue University, Indiana, to be among the factors influencing mould (*Oospora lactis*) growth in cream [*R.A.M.*, xx, p. 407]. A clean centrifugal separator gives better results than water separators or hand-skimming. The cream should be kept at a temperature of 60° F. or below, especially during the summer months, when the percentage of samples with high mould mycelium counts may be considerable. The age of the cream is important in relation to its mould content, 47 per cent. of the cans examined after 7 days showing more than 4·5 mm. compared with 7 per cent. at 4 days. Cans with a fat content of 30 to 50 per cent. showed a decrease in mould growth as compared with those with less than 30 per cent. Stirring was found to reduce the mould content of the cream, but at the same time tended to impair the flavour. Large shipments, e.g., 40 lb. cream in a 5 gal. can, show less mould than smaller lots of 5 or 10 lb.

GARRISON (E. R.) & GHOLSON (J. H.). **Mold mycelia in cream.**—Abs. in *J. Dairy Sci.*, xxiv, 6, pp. 546–547, 1941.

At the Department of Dairy Husbandry, Missouri Agricultural

Experiment Station, the authors made the following determinations on 655 cream samples collected at three-weekly intervals from October, 1940, at each of the four cream stations at Columbia: titratable acidity, formol titration, modified Wildman MBB (methylene blue-borax) test, and the plate count for mould [chiefly *Oospora lactis*: see preceding and next abstracts] on acidified potato dextrose agar. Statistical data showed a very significant correlation between titratable acidities and MBB ratings, and indicated that other factors besides the amount of mould in the cream are involved in the rating. [Udder infection and late lactation in cows of the University Herd were shown by the same writers (pp. 547–548) to be two of the factors concerned.]

REID (W. H. E.), EDMONDSON (J.), & ARBUCKLE (W. S.). **The effect of various factors on mold mycelia in cream and butter.**—*J. Dairy Sci.*, xxiv, 6, p. 548, 1941.

At the Department of Dairy Husbandry, Missouri Agricultural Experiment Station, the writers found that mould [chiefly *Oospora lactis*] mycelia in cream [see preceding abstracts] multiply rapidly at relatively high temperatures and are very tolerant of acidity, while a direct correlation was also established between the period of keeping and the incidence of infection. Stirred samples contained more mould than non-stirred, whereas in the resultant butter the position was reversed, the mycelia having been so extensively disintegrated in the course of stirring that they could not be counted as positive fields by the MBB test.

WALTER (W. G.) & HUCKER (G. J.). **The use of the contact plate method to determine the microbial contamination on flat surfaces.**—*Tech. Bull. N.Y. St. agric. Exp. Sta.*, 260, 34 pp., 4 figs., 1941.

A full description is given of a contact plate method developed by the authors for determining the type and extent of bacterial contamination on flat-surfaced utensils after cleaning. The contact plate consisted of a tin can cover filled with sterile agar and kept in a Petri dish. The test was made by placing the plate in contact with the surface to be examined for four seconds and counting the colonies which developed on incubation at 32° C.

BRIERLEY (P.). **Current-season development of virus symptoms in Tulips.**—*Phytopathology*, xxxi, 9, pp. 838–843, 1 fig., 1941.

In preliminary trials in 1938 at the United States Horticultural Station, Beltsville, Maryland, the 'strong mottle' virus of Easter lily [*Lilium longiflorum*] was inoculated from this species into *L. formosanum* by leaf-rubbing with carborundum, multiple needle puncture, and hypodermic needle injection, ten plants being used for each method and the positive reactions numbering 9, 4, and 0, respectively [*R.A.M.*, xix, p. 411]. In a parallel test with inoculum from necrotic-flecked *L. longiflorum* 8, 1, and 2 *L. formosanum* plants contracted infection, respectively. On the basis of these results leaf-rubbing was adopted as the standard method of inoculating lily viruses into plants other than tulip, for which the hypodermic needle technique was retained [ibid., xvii, p. 603].

A comparative series of greenhouse tests was carried out in March, 1939, by the two methods, with inocula consisting of a 1 : 20 dilution in tap water of expressed juice of tulip viruses 1 and 2, the latent virus of lily, the strong mottle virus of *L. longiflorum*, and several cucumber virus strains. No symptoms appeared during the current season, but in 1940 the plants arising from bulbs of the inoculated individuals developed floral or foliar disorders, the former being chiefly associated with the tulip viruses and the latter with the others tested. The percentages of infection induced by the cucumber viruses were 15·8 and 31·9 for the needle and leaf-rubbing methods, respectively, the corresponding figures for the tulip viruses and the latent and strong mottle viruses of lily, tentatively grouped with the tulip strains [ibid., xix, p. 411], being 30·9 and 59·2, respectively. Under the conditions of these experiments, therefore, the leaf-rubbing technique proved superior to the hypodermic needle for the transfer of the viruses under observation.

During January and February, 1940, forced Clara Butt tulips were inoculated by leaf-rubbing with a number of virus collections from lily and McWhorter's two tulip viruses [ibid., xvii, p. 603], the cucumber virus strains causing 41·8 per cent. infection, those from tulip 48·1, and the lily virus complexes 44·2; again, foliar symptoms developed only as a result of inoculation by the cucumber viruses (which also attacked the flowers), the others inducing current-season flower-breaking. The cucumber viruses cause a duller red striping or feathering of the flowers than that associated with the tulip strains. A conspicuous blemish is commonly present near the distal end of the outer perianth parts, and the foliage is often flecked or striped with white or grey. The most virulent strain of cucumber virus hitherto isolated from lily induced on tulips, after a month's incubation, symptoms closely resembling those described by Ainsworth in a tulip spontaneously infected by cucumber virus 1 in England [ibid., xviii, p. 182].

LASKARIS (T.) & DODGE (B. O.). **Red-blotch of Hippeastrum.**—*Bull. Torrey bot. Cl.*, lxviii, 7, pp. 463–466, 5 figs., 1941.

*Stagonospora curtisii*, normally causing only an unimportant spotting of *Hippeastrum* foliage and flowers in the United States [*R.A.M.*, xiv, p. 448; cf. also xviii, p. 572], was in March, 1941, reported to be severely attacking a collection of these plants raised at Riverdale-on-the-Hudson from bulbs obtained from Florida. The flower stalks were badly stunted and distorted by unilateral cankers, the fungus probably entering by way of the bruises on the epidermis or underlying tissues made by sand or other foreign particles during the process of emergence of the highly compressed flower shoots from the enveloping bud scales. The cankers are of conspicuous appearance, bright red or vermilion, becoming soft, brown, and sunken at the centre as they enlarge and elongate up to several inches in length and ¼ to ½ in. in diameter. At an advanced stage of infection the white or brownish-grey mycelium of the pathogen develops in the centre of the cankers, the borders of which retain their vivid red coloration. The elongated, red spots on the leaves and red streaks on the scapes characteristic of the normal form of the disease were also observed. Positive results were secured

in inoculation experiments with *S. curtisii* from potato dextrose agar cultures on wounded and unwounded *Hippeastrum* plants, extensive spotting following the application of the mycelium to the leaves or spraying with mycelial or pycnidial suspensions, whereas cankers developed only on shoots previously injured at the base by scraping the epidermis.

Fourteen genera of the Amaryllidaceae are known to be susceptible to infection by *S. curtisii* [ibid., xiv, p. 448].

Baker (K. F.) & Thomas (H. Earl). **Failure of Rose bud-unions caused by Chalaropsis thielavioides.**—Abs. in *Phytopathology*, xxxi, 9, p. 859, 1941.

*Chalaropsis thielavioides* is stated to have been largely responsible during the dry summer months of 1940 for failures in the union of rose-bud shields with Manetti and Odorata root-stocks in the Santa Clara Valley of California, the pathogen being identical with that implicated in a similar trouble in New York [*R.A.M.*, xix, p. 409]. In repeated tests the buds were rapidly killed and blackened, with only limited discoloration of the root-stock. Peyronel's strain of the fungus from lupin [ibid., vii, p. 582], Miss Hamond's walnut isolate [ibid., xiv, p. 408], and Bliss's *Ceratostomella* [*radicicola*: see above, p. 13] from date roots were non-pathogenic to Manetti stems. In the laboratory the rose strain attacked stems of *Rosa odorata*, *R. chinensis* var. *manetti*, *R. multiflora*, *R. longicuspis*, *R. nutkana*, *R. californica*, *R. gymnocarpa*, sweet cherry, peach, almond, black and Persian walnuts, pear, and *Prunus mariana*, and made slight growth on orange and quince stems and elm (*Ulmus pumila*) roots [ibid., xiv, p. 726], but stems of *R. laxa*, apple, and numerous collections of the Ragged Robin rose were immune. *R. odorata* was found to be the most susceptible of the root-stocks, followed by Manetti and *R. multiflora*.

Bond (T. E. T.). **A leaf spot disease of Annual Phlox.**—*Trop. Agriculturist*, xcvi, 6, p. 380, 1941.

With reference to his record of *Septoria drummondii* on *Phlox drummondii* in Ceylon [*R.A.M.*, xx, p. 470], the author states that a record for 1938 has now been brought to his notice.

Bender (T. R.). **Fusarium die-back of American Holly.**—*Plant Dis. Reptr*, xxv, 15, pp. 403–406, 1941. [Mimeographed.]

In July 1940 American holly (*Ilex opaca*) trees in New Jersey were observed by the author to be affected by a severe branch and twig die-back, which had first appeared on a single old-established tree in 1935.

One of the earliest symptoms was a wilting of the current season's growth. The affected tips were often entirely defoliated. Infection generally started at the tip of the twig and spread rapidly downwards. The newly killed twigs and leaves were black. Longitudinal sections through affected twigs showed a brown discoloration of the cortex and pith, with general breakdown of cell structure in the pith. The xylem cells were unaffected. The most conspicuous symptom was the

stems standing out sharply against the foliage of neighbouring healthy limbs.

When the bark of the older stems was cut away in the diseased part, a brownish-black discoloration of the cortical tissue became apparent, often extending longitudinally to a distance of 5 or 6 in., and in advanced cases girdling the stem. Diseased material constantly showed the presence of a fungus tentatively referred by Dr. O. Reinking to *Fusarium solani* var. *martii*, not hitherto recorded as causing such a disease.

The results of inoculation experiments indicated that the fungus is capable of entering the plant directly through very young leaves, wounds in young and old stems, and perhaps through the terminal portions of unwounded stems of the current year's growth; it may possibly enter through the blossoms.

For control purposes all infected branches and fallen leaves should be removed and burnt. Pruning cuts and mechanical injuries should be treated with an antiseptic and a wound dressing.

Tucker (C. M.) & Burkholder (P. R.). **Calcium deficiency as a factor in abnormal rooting of Philodendron cuttings.**—*Phytopathology*, xxxi, 9, pp. 844–848, 2 figs., 1941.

*Philodendron* (?) *giganteum* cuttings placed in coarse river sand for rooting in a greenhouse in St. Louis County, Missouri, in 1939 developed foliar wilting and chlorosis, followed by necrosis, the axillary bud making little or no growth; the final stages of the disorder were characterized by a dark brown rot, starting at the lower internode and progressing upwards to the node. The roots of the affected cuttings were short (1 to 2 in.), with abnormally few branch roots, and superficially discoloured, the tips being blunt, sometimes slightly swollen and knob-like, and brown, like the older portions, while the root hairs were collapsed, brown, and obviously non-functional. The results of experiments in 1939–40 indicated that the cuttings were suffering from a lack of calcium, while an inadequate water supply may also have been concerned in the trouble.

Davis (B. H.). **A new Cercospora on Leucothöe.**—*Mycologia*, xxxiii, 5, pp. 523–525, 1 fig., 1941.

A new species, *Cercospora leucothöes*, is described as causing brown to greyish-brown circular or irregular spots, some with a narrow, black, raised border, on leaves and stems of *Leucothöe catesbaei* in nurseries and ornamental plantings in New Jersey and on Long Island.

Martin (W. J.) & Kernkamp (M. F.). **Variation in cultures of certain Grass smuts.**—*Phytopathology*, xxxi, 8, pp. 761–763, 1941.

Monosporidial isolates of *Ustilago sphaerogena* from *Echinochloa crus-galli*, *U. neglecta* [*R.A.M.*, xii, p. 617] from *Setaria lutescens*, *Sphacelotheca panici-miliacei* from *Panicum miliaceum*, and *Sorosporium cyntherismae* from *Cenchrus* sp., and single promycelial cell isolates of *U. crameri* from *Setaria italica* [ibid., xviii, p. 174] gave rise in potato dextrose and malt agar cultures at the Minnesota Agricultural Experiment Station to varying numbers of biotypes differing among

themselves in colour, topography, type of margin, consistency of colony, and growth rate and direction. In general, malt agar was more conducive to sectoring than potato dextrose except in the case of *U. crameri*. Many of the sectors were shown by their persistence on subculturing to be true variants.

HANSON (E. W.) & MILLIRON (H. E.). **The relation of the Curculionid, Anacentrinus deplanatus, to root rot and basal stem rot of Barnyard Grass, Echinochloa crusgalli.**—*Phytopathology*, xxxi, 9, pp. 832–837, 3 figs., 1941.

*Echinochloa crus-galli* at the Minnesota Agricultural Experiment Station was found to suffer much more extensively and severely from fungal and bacterial root and basal stem rots when infestation by the weevil *Anacentrinus deplanatus* was simultaneously present. Thus, in two lots of some 500 plants, one infested and one free from weevil attack, the percentages of fungal infection in the stem bases, roots, and insect frass of the former were 95, 68, and 100, respectively, compared with 15 and 49 per cent., respectively, for the stems and roots of the latter. *Fusarium* spp., including *F. culmorum* and *F. graminearum* [*Gibberella saubinetii*], predominated, being isolated from 69 per cent. of the stem bases and 41 per cent. of the roots of infested plants, and from 50 per cent. of the frass, while other organisms present were *Rhizoctonia* [*Corticium*] *solani*, *Helminthosporium* sp. (mostly *H. sativum*), and species of *Alternaria*, *Aspergillus*, *Basisporium*, *Brachysporium*, *Cephalothecium*, *Chaetomium*, *Penicillium*, *Stemphylium*, and *Trichoderma*, as well as at least three kinds of bacteria, all of which, together with *H. pedicellatum* [*R.A.M.*, xvi, p. 735] and a species of *Trichoderma*, were found to be attached to the exterior of the larvae, pupae, and adults of the weevil. The relative prevalence of *Helminthosporium* on the stems was considerably greater on non-infested than on infested plants (36 as compared with 7 per cent.), thereby confirming the senior writer's observations (with J. J. Christensen, *Phytopathology*, xxx, pp. 7–8, 1940) in connexion with the foot and root rots of other Gramineae, to the effect that species of this genus are more abundant on young and vigorously growing plants than on those approaching maturity or weakened by other pathogens or adverse environmental conditions.

PARRIS (G. K.) & RIPPERTON (J. C.). **Reactions of Napier Grass, Merker Grass, and their crosses to Helminthosporium eye spot.**—*Phytopathology*, xxxi, 9, p. 855, 1941.

In a paper still in the press the first-named author has described the eye spot of Napier grass [*Pennisetum purpureum*] caused by *Helminthosporium sacchari* in Hawaii and drawn attention to the resistance to the disease of Merker grass [*P.* sp.] and certain selections from the crosses Napier × Merker and reciprocals: four such selections have, in fact, been recommended as substitutes for Napier. In greenhouse inoculation experiments with spores of ten isolates of the fungus, Merker and its crosses with Napier were again shown to be resistant to, though not immune from, eye spot, which develops on the leaves and leaf sheaths in the form of diffuse, smudge-like discolorations, the

stems being seldom affected. It is clear from the data in hand that the resistance of Merker is a hereditary character, but its basis is not yet understood, though significance is attached to the thickness of the stem rind in this species as compared with Napier.

GRAYSON (A. R.). **Paspalum ergotism in Cattle.**—*J. Dep. Agric. Vict.*, xxxix, 9, pp. 441–442, 446, 4 figs., 1941.

During the autumn of 1941 *Paspalum dilatatum* and *P. distichum* were heavily infested in north-eastern Victoria and parts of Gippsland by *Claviceps paspali* [*R.A.M.*, xx, p. 23], which is stated to have been known in Australia only since 1935 [ibid., xv, p. 724], though reported from the United States in 1902. Continued ingestion of the diseased grasses induces in cattle nervous symptoms similar to, but generally milder than, those due to the consumption of rye infested with ergot [*C. purpurea*].

JONES (F. R.), ALLISON (J. L.), & SMITH (W. K.). **Evidence of resistance in Alfalfa, Red Clover, and Sweet Clover to certain fungus parasites.** —*Phytopathology*, xxxi, 8, pp. 765–766, 1941.

Observations in lucerne, red clover [*Trifolium pratense*], and white sweet clover [*Melilotus alba*] nurseries at Madison, Wisconsin, in 1940, supplemented by certain information from field inspections, yielded evidence of resistance or varying susceptibility to the following fungal pathogens, ordinarily regarded as of minor importance: (*a*) lucerne, *Pseudopeziza medicaginis*, *Peronospora trifoliorum*, *Stagonospora meliloti* [*R.A.M.*, xviii, p. 320], and *Stemphylium botryosum* [*Pleospora herbarum*: ibid., xx, p. 306] (which affected Cossack and Grimm significantly less than Ladak); (*b*) red clover, *Erysiphe polygoni*, *S. sarciniforme* [ibid., xx, p. 582], *Uromyces trifolii fallens* [*U. fallens*: ibid., xix, p. 161], and *Cymadothea* [or *Dothidella*] *trifolii* [ibid., xiv, p. 367]; and (*c*) sweet clover, *Pseudopeziza meliloti* and *Stagonospora meliloti*.

PILAND (J. R.) & IRELAND (C. F.). **Application of borax produces seed set in Alfalfa.**—*J. Amer. Soc. Agron.*, xxxiii, 10, pp. 938–939, 1 fig., 1941.

A lucerne planting on Cecil fine sandy loam soil in North Carolina, with a $P_H$ of 6·6 and an available boron content of 0·19 p.p.m., showed severe boron deficiency symptoms (yellowing) [*R.A.M.*, xx, p. 306] in 1940. In the section of the field receiving a 20 lb. application of borax in the late winter of 1941 the plants made a good set of seed, whereas none was obtained from those in the untreated part. The untreated hay was found to contain 4·80 p.p.m. boron and the treated 14·40, while the amounts of the element in the top and subsoils were increased from 0·19 to 0·21 and 0·18 to 0·25 p.p.m., respectively, by the 20 lb. application. It is thought that the long-standing failure to maintain satisfactory stands of lucerne in the State are at any rate partially due to boron deficiency.

POWERS (W. L.). **Boron—a minor plant nutrient of major importance.**—*Bett. Crops*, xxv, 6, pp. 17–19, 36, 3 figs., 1941.

Following a brief survey of previous investigations on the value of

boron as a remedy for various deficiency diseases of agricultural crops, the writer gives details of 36 trials conducted from 1937 to 1940 on 24 crops and 20 soil types in Oregon. A single application of 40 lb. boric acid per acre on Willamette loam produced a lucerne yield of 4·88 tons, compared with 2·83 tons in the control plot, coupled with absence of yellow top [see preceding abstract] for 3½ years; the net profit in this instance was computed at $14.40 per acre. In other tests the lucerne yields were augmented by increasing rates of borax applications up to 60 lb. per acre, a 30 lb. dose being probably safe for most purposes. It is estimated that there are now some 50,000 acres of lucerne in the Willamette Valley capable of yielding ½ to 1 ton more per acre if treated with borax at the rate of 30 lb. per acre, costing about $1 per acre. The losses due to beet canker [*R.A.M.*, xviii, p. 817] (which is commercially, but not completely, controllable by borax treatment at the standard rate), and cracked stem of celery [ibid., xx, p. 192] are estimated at 8 to 10 and up to 50 per cent. of the crops, respectively.

HARRIS (M. R.). **Rosellinia root rot of Alfalfa in California.**—*Plant Dis. Reptr*, xxv, 15, p. 407, 1941. [Mimeographed.]

During January, 1941, a lucerne field near Banning, California, showed circular areas within which every plant had been killed by *Rosellinia necatrix*. The fungus appeared to have been spread by cultivation from a single original infection. It had not previously been reported within 300 miles of the locality, or on lucerne in the United States.

HERBST (W.). **Zum Stande unserer Erkenntnis über die Biologie des Fusikladiums.** [On the status of our knowledge concerning the biology of the *Fusicladium*.]—*Forschungsdienst*, xi, 5, pp. 553–565, 1941.

The writer discusses the available information on the biology of apple scab (*Venturia inaequalis*) under the following headings: (1) economic, politico-nutritional, and socio-biological significance of the disease in Germany and the need for intensive control measures; (2) study of the life-cycle and biology of the causal organism; (3) investigations of the biological foundations for scab infection in the hosts of the fungus; (4) researches on the course of the parasitic relationship between the fungus and its host, including the connexion with environmental (especially meteorological) factors; and (5) methods of intensive control applicable in Germany. Much of the information presented here has already been noticed from other sources [cf. *R.A.M.*, xvi, p. 618; xviii, pp. 37, 531, *et passim*], but among other points of interest may be mentioned the importance attached to the socio-political repercussions of the enormous annual losses from the disease, conservatively estimated (for the apple harvest alone) at RM. 40,000,000; and the distribution of physiologic races of *V. inaequalis* from the north-west to the south-east.

STOY (O.). **En mindre bekant sjukdom på Äppelträd.** [A lesser known disease of Apple trees.]—*Fruktodlaren, 1940*, 4, pp. 132–134, 4 figs., 1940.

A large number of apple trees in two localities of Malmöhus, Sweden,

were observed in the early summer of 1940 to bear cankers which were identified by the Plant Protection Institute, Stockholm, as caused by *Nectria galligena*, a relatively unfamiliar pathogen in Sweden.

WORMALD (H.). **Notes on plant diseases in 1940.**—*Rep. E. Malling Res. Sta., 1940*, pp. 55–58, 1941.

These notes [cf. *R.A.M.*, xix, p. 690] contain the following items of interest. Dwarf lateral scorch of raspberries [ibid., xx, p. 72] was not present at East Malling during 1940, and no inquiries were received about it, though a year before it had been very severe. The evidence obtained confirmed the view that the trouble is induced by high temperatures in mild winters.

Spores of the *Fusarium* stage of *Nectria galligena* [loc. cit.] collected from apple cankers after a frosty period when temperatures dropped as low as 12° F. germinated within 24 hours at ordinary room temperature.

*Stereum purpureum* was frequently found in association with 'papery bark' of apple trees [loc. cit.]. Apple stems left lying about after the trees have been dug up owing to papery bark serve as a source of infection; they should be burnt immediately. Infection by *S. purpureum* frequently causes failure in top-grafting, and frame-working is recommended instead.

Early in 1941 dead spurs of Conference pear were observed bearing pustules of *Monilia cinerea* [*Sclerotinia laxa*: ibid., x, p. 322] on the axis of the spur and the dead flower stalks, the remains of which had persisted, indicating that blossom wilt had occurred in the spring of 1940. The disease is unusual in pears, and has not before been observed on the Conference variety. A single pear shoot was affected by powdery mildew (*Podosphaera leucotricha*) in a garden at Maidstone.

Further observations have demonstrated that the angular leaf spot of apples previously reported from southern England [ibid., xix, p. 711; xx, p. 193] was caused by a froghopper [*Cercopis sanguinea*], the fungi found being saprophytic.

A wilting of the shoots in the layer rows of plum and cherry varieties used as root-stocks killed about 40 per cent. of the shoots in the Brompton plum variety, and over 50 per cent. in St. Julian A. The disease is attributed to a species of *Cylindrocladium*. Cherries from Surrey showed a similar wilt and yielded the same fungus, which was also isolated from wilted lupins.

Early in July gooseberry leaves showed severe spotting and were turning yellow. Lesions bearing conidia of *Pseudopeziza ribis* were found on the leaf stalks and fruit. A few spots on the fruit bore conidia, and others, which were small and dark and had ill-defined margins, with a raised spot in the centre, appeared to represent the early stage of fruit infection.

In August shoots of *Ribes fasciculatum chinense* were found bearing mycelium of *Sphaerotheca mors-uvae*.

A row of young walnut trees of selected English varieties showed the presence of *Pseudomonas* [*Xanthomonas*] *juglandis* [ibid., xx, p. 237]. The only tree with any appreciable crop belonged to the Patching variety, and even on this about 50 per cent. of the fruits were affected.

Harris (R. V.) & Wormald (H.). **Plant pathology, mycology, and bacteriology.**—*Rep. E. Malling Res. Sta., 1940*, pp. 23–25, 1941.

This report of research work at East Malling during 1940 [cf. *R.A.M.*, xix, p. 716] contains, *inter alia*, the following items of interest. Very few further cankers (*Pseudomonas mors-prunorum*) [ibid., xix, p. 717] were recorded in 1940 on Victoria plums worked on stems of other varieties. The evidence indicates that plum bacterial canker can be controlled by using trees with resistant stems, Purple Pershore and Myrobolan B providing the most successful stems so far. Measurements of cankers on plums experimentally inoculated in 1939 proved that the stems of Pershore, Denniston's Gage, and Victoria are very highly susceptible, those of President, Utility, Warwickshire Drooper, and Purple Egg intermediate, and those of Myrobolan B resistant, seldom developing any cankers.

Further work on raspberry mosaic [ibid., xix, p. 716; xx, p. 69] confirmed the widespread infection of the Lloyd George variety with a severe form of mosaic 2. The newly introduced Preussen cane was found to approximate closely to the symptomless-carrier reaction of Lloyd George, though it sometimes shows leaf symptoms. Burnet Holm and Pyne's Royal canes were shown to be entirely permeated with virus with indistinct and intermittent symptom expression, while cane of a selected clone of Norfolk Giant proved to be free from virus.

Wormald (H.) & Montgomery (H. B. S.). **Bacterial blossom blight of Pear trees.**—*Rep. E. Malling Res. Sta.*, 1940, pp. 58–59, 1941.

Pear trees in Kent and Essex are frequently affected by a blackening and wilting of the flowers of a truss, the discoloration extending into the stalk of the cluster of flowers and sometimes into the older parts of the spur. Frequently a flower bud and its surrounding scale leaves turn black soon after the bud begins to swell, and the flowers either do not open or expand irregularly and imperfectly.

Isolations from affected material in most cases showed the presence of an organism apparently closely related to, if not identical with, *Pseudomonas prunicola*. Inoculations of pear flower trusses with pure cultures of this organism resulted in complete blackening and withering of the flower clusters.

The condition has been observed on most varieties of pears cultivated in England; locally, Durondeau and Pitmaston are most often affected, but in some years Catillac is also seriously attacked. Specimens of a similar disease were received from Jersey, but the associated organism was different. Some 30 years ago a similar disease was reported from the west of England, and was associated with *Bacillus barkeri* [*R.A.M.*, iv, p. 469]. The behaviour of this organism in culture differs from that of *P. prunicola*, and they are considered to be distinct species. In experiments at East Malling another organism also gave successful results in inoculation experiments, so that, apparently, the symptoms may be caused by more than one species of bacteria. A bacterium resembling that obtained from the flowers and spurs was also isolated from leaf and fruit spots.

Soon after the buds expand in the spring, infection develops, and it is thought that the organism overwinters in or on the buds, which probably become infected from spurs attacked the previous year. All affected spurs should therefore be cut out directly they become noticeable, as they constitute a possible source of infection both for the current year's leaves and fruits and for the next year's buds.

EATON (F. M.), MCCALLUM (R. D.), & MAYHUGH (M. S.). **Quality of irrigation waters of the Hollister area of California with special reference to boron content and its effect on Apricots and Prunes.** —*Tech. Bull. U.S. Dep. Agric.* 746, 59 pp., 5 pl., 3 maps, 1941.

In connexion with their fully tabulated analytical studies on the quality of the irrigation waters of the Hollister area of California, constituting the upper portion of the Santa Clara Valley in San Benito County, the writers describe the symptoms developing in apricots, prunes, and other plants as a result of excessive concentrations of boron (upwards of 0·3 p.p.m. in the case of the sensitive group, comprising stone and citrus fruits, avocado, persimmon, grapes, apples, pears, Kadota fig, thornless blackberry, pecans, American elm, English and black walnuts, and Navy beans [*Phaseolus vulgaris*]). Injury to the leaves of stone fruits is manifested by spots or longitudinal strips of brown, corky tissue along the petioles and midribs, representing the sloughing-off of scales as a result of the death of underlying tissue and the formation of cork parenchyma. Thickening of the bark of the trunk and twigs of apricots is sometimes observed, while shortening of the internodes may occur. The twigs of affected trees are abnormally stiff, and readily break transversely on bending. In apricots the first symptom on new growth is a die-back of the shoot tips, following the breakdown of the bark in the terminal region, while nodular enlargement of the first- and second-year twigs is a common but not invariable feature. The fruit of severely diseased trees is often undersized with necrotic areas in the epidermis and underlying flesh, while discoloration and more or less extensive shrinking may also be present. In one case the flesh of badly damaged apricot fruit was found to contain 732 p.p.m. boron on the basis of dry weight. Imperial prunes, which are more sensitive than those of the Sugar variety, exhibit symptoms resembling those of apricots, whereas in Sugar prunes and peaches the breakdown of the bark usually starts immediately above the nodes. Thickening of the foliage, corkiness of the midribs and petioles, enlarged nodes, death of the shoot tips, and gumming are all typical features of boron injury in French prunes. A conspicuous symptom of the trouble in peaches is the breakdown of the cortical tissues of the young twigs, generally initiated just above the leaf axils, whence it extends and commonly encircles the twig. Poor development, insipidity, and discoloration of the fruit are common to both peaches and apricots, while the former also show splitting of the pits, which is, however, not exclusively associated with boron toxicity.

Walnuts, vines, and other plants suffering from excess accumulations of boron develop foliar chlorosis beginning at the margins, followed by necrosis and the death of the affected tissues.

Bucksteeg (W.). **Untersuchungen über die Wirkung von Kältegraden auf Keim- und Infektionsfähigkeit der Konidien von Sclerotinia cinerea Schroet. und Sclerotinia fructigena Schroet.** [Studies on the effect of low temperatures on the germinability and infection capacity of the conidia of *Sclerotinia cinerea* Schroet. and *Sclerotinia fructigena* Schroet.]—*Z. PflKrankh.*, l, pp. 507–512, 1940. [Abs. in *Zbl. Bakt.*, Abt. 2, ciii, 21–24, p. 413, 1941.]

When apples, plums, and cherries inoculated with *Sclerotinia cinerea* [*S. laxa*] and *S. fructigena* [*R.A.M.*, xviii, p. 534] were stored at varying degrees of cold, the conidia were found to be germinable and capable of infection after six months' exposure to a temperature of $-14°$ to $-18°$ C., though their virulence, as judged by the rapidity of the attack on inoculated apples, gradually declined under these conditions. No germinable conidia were found after ten weeks on diseased fruits overwintering in the open.

Huber (G. A.) & Baur (K.). **Brown rot on stone fruits in Western Washington.**—*Phytopathology*, xxxi, 8, pp. 718–731, 5 figs., 1941.

Brown rot of stone fruits (*Sclerotinia fructicola* and *S. laxa*) was particularly severe in Western Washington in 1936, when it caused reductions of yield of 60, 40, and 90 per cent. in Italian prunes and sour (Montmorency, English Morello, and Early Richmond) and sweet cherries, respectively. The fungi were isolated on acidulated potato dextrose agar from blossoms, fruits, 'shedders' (half-grown fruits ceasing to develop further), cankers, twigs, or mummies of these hosts, peach, and apricot, while an unidentified organism, S.C. No. 1, was isolated from prune 'shedders', mature fruits, and twigs with adhering mummies.

Inoculation experiments were conducted with *S. fructicola* and *S. laxa* on the blossoms, twigs, and fruits of all four kinds of fruit, of which apricot, cherry, and peach contracted blossom blight on infection with both species, whereas in the case of Italian prune the floral parts became diseased but the pedicels were not involved. *S. laxa* caused definite twig cankers on apricot, cherry, and peach, but not on prune, while *S. fructicola* gave negative results in this respect. Both species induced decay in apricot, cherry, peach, and prune fruits. The sporodochia of *S. laxa* were found on cankers, blighted twigs and fruit spurs, and mummies overwintering on apricot, cherry, and peach trees, and on prune mummies and blighted twigs, the former also bearing an abundance of apothecia of *S. fructicola*.

Blodgett (E. C.). **Studies on Peach viroses in Idaho.**—Abs. in *Phytopathology*, xxxi, 9, pp. 859–860, 1940.

The outstanding symptom of a peach disease reported from Idaho in 1938 and termed 'wart' is the development of verrucose excrescences on the fruits, especially near the stylar end. The insertion of buds from affected trees into healthy stocks results in the formation of warts on the fruits of the latter. Studies on the host range of the disease and its occurrence in two forms, one known as 'smooth' and the other as 'crease wart' are in progress. Peach mottle, recognized in the State

since 1939, and regarded as distinct from mosaic, is readily transmissible from diseased to healthy trees, while buds from mottled peach trees placed on sound Bing cherry induce symptoms resembling those of mottle leaf of the latter host, and Montmorency cherries similarly treated develop severe die-back of the current growth. Another common disorder of Idaho peaches involving foliar chlorosis, usually accompanied by necrosis and ending in defoliation, appears to be similar to the X disease [*R.A.M.*, xx, p. 540].

STODDARD (E. M.). **A new host for the X-disease virus.**—*Plant Dis. Reptr*, xxv, 13, p. 361, 1941. [Mimeographed.]

X disease of peaches [*R.A.M.*, xx, p. 346] has been transmitted to *Prunus besseyi* by budding. The symptoms were expressed in dwarfing of the growth and yellowing of the foliage. Plants of *P. hortulana* budded with diseased peach buds showed no symptoms, but the shoots growing from the diseased buds developed characteristic signs of the disease. This suggests that *P. hortulana* is either immune or is a symptomless carrier, and experiments to settle this point are in progress.

WOODHEAD (C. E.) & CHAMBERLAIN (E. E.). **Report on a survey of small-fruit culture in New Zealand, November–December, 1939.**—*Orchard., N.Z.*, xiii, pp. 110–117, 139–141, 1940.

This report includes the following information on diseases. Strawberry root rot of obscure origin has necessitated the virtual abandonment of the industry in Hawke's Bay, Wanganui, and Wairarapa, and causes heavy losses, frequently involving over 50 per cent. of the crop, in Auckland, the sole remaining district in North Island in which commercial cultivation is still practised. The acreage of strawberries planted at Christchurch has been much reduced, while severe damage has likewise been reported from Waimate and parts of Central Otago. Recent work indicates that a fungus may be the agent of the trouble.

Yellow edge [*R.A.M.*, xix, p. 644] probably comes next in importance to root rot, and may be equally injurious in Auckland, where the prolific but highly susceptible Marguerite variety has had to give place during the last eight years to the comparatively resistant but much less productive Captain Cook. Over 70 per cent. infection has been shown by certain lines of Marguerite, with a corresponding loss of crop of 50 per cent. Royal Sovereign is another very susceptible variety, while Laxton's Noble, like Captain Cook, may show moderately high percentages of infection. Madame Melba and some locally produced seedling varieties appear to be free from yellow edge. One healthy line of Royal Sovereign was found in Central Otago. An attempt is in progress to raise clean lines of Marguerite, Captain Cook, Royal Sovereign, and other standard varieties. Crinkle has not yet been definitely recorded in New Zealand, but is suspected in various districts. Leaf spot (*Mycosphaerella fragariae*) is prevalent throughout the Dominion, causing appreciable damage in Auckland unless regular spraying with Bordeaux is practised.

Cane wilt (*Leptosphaeria coniothyrium*) [loc. cit.] is the most destructive disease of raspberries, but here again a routine schedule of Bordeaux mixture gives satisfactory control. Some plantings were so

heavily infected that very little fruit was produced. *Armillaria mellea*, though not widespread, may cause heavy sporadic losses in the raspberry crop, especially in the Greytown and Christchurch areas. The spread of the fungus may be arrested by isolating the affected plantings and rotation with a non-susceptible crop. Silver leaf (*Stereum purpureum*) has been observed on raspberries in several districts, the incidence of infection being only moderate but the symptoms very severe, the diseased canes either dying or becoming too weak to bear fruit. *Plectodiscella veneta* is widespread but generally unimportant in the Motueka-Riwaka district; this is the first report of the fungus from New Zealand. Crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) appears to be fairly prevalent, and observations in the Island Block region of Otago indicate that it definitely weakens its host. Suspected cases of raspberry mosaic are under investigation. A disorder involving the almost complete absence of edible raspberry fruit appears to be of physiological origin.

*S. purpureum* is the most virulent pathogen of currants and gooseberries, especially the latter, beds of which normally remaining in full production for 25 or 30 years and upwards often have to be replaced after ten or twelve on account of the disease, notably in the Greytown district, where an incidence of over 50 per cent. infection is not infrequent. *M. grossulariae* is also prevalent on both hosts, particularly at Greytown, and treatment with Bordeaux mixture is often necessary. *Verticillium albo-atrum* was recently observed on gooseberries in a nursery bed at Greytown. Steps should be taken to prevent the further dissemination of this very troublesome disease by avoiding material from contaminated sites. Bronze-coloured excrescences on gooseberry leaves and the associated failure of fruit bud development have caused fairly heavy losses during the last two or three years, especially in young beds. Physiological factors or an Eriophyid mite may be implicated.

SNELL (W. H.). **Blister rust studies of three patches of Red Currants in New York.**—*Phytopathology*, xxxi, 8, pp. 732–740, 1 graph, 1941.

This is a progress report on investigations proceeding in the Adirondacks, New York, concerning the part played by red currants in the dissemination of white pine blister rust (*Cronartium ribicola*) and the wisdom or otherwise of a policy of wholesale eradication of the alternate host from the vicinity (a radius of 900 ft.) of plantings of the trees.

Compared with black currants, or even wild gooseberries, red currants are relatively resistant to blister rust [*R.A.M.*, xx, p. 504], and consequently more open to the influence of the various factors limiting production of the sporidial inoculum. The analysis in 1940 of three patches of red currants showed that only one or two bushes in a row of six or twelve are very slightly, if at all, infected; that the diseased leaves tend to begin falling early (in one case before the end of July), with the result that the defoliation of this species is complete before that of black currants and wild gooseberries. In two lots of neglected red currants on abandoned farms, 75 to 96 per cent. of the infection spots had become necrotic before the end of July, prior to the

production of teleuto- or even of uredosori. One bush bore only 6,468 teleutosori (41 instead of the 2,400 per sq. in. to be expected under optimum conditions). Moreover, 95 per cent. of the teleutosori on these bushes were only 22 to 50 per cent. the normal length for *Ribes sativum* of 800 to 1,360 $\mu$, and most of these were apparently dead. On the bushes of the same two patches the dead infection spots were 0·0112 sq. in. in area, while the newly formed living ones averaged only 0·0036 sq. in., some being so minute as to accommodate only a single uredosorus.

Östlind (N.). **Virussjukdomar hos Jordgubbar.** [Virus diseases of Strawberries.]—*Fruktodlaren, 1940,* 3, pp. 89–91, 2 figs., 1940.

In this account of strawberry yellow edge and crinkle, investigated by the writer on a visit to England, it is stated that the former [*R.A.M.*, xx, p. 72] has been observed on the Royal Sovereign variety in Sweden.

Zeller (S. M.) & Weaver (L. E.). **Stunt disease of Strawberry.**—*Phytopathology,* xxxi, 9, pp. 849–851, 1 fig., 1941.

'Stunt' of strawberries, recognized in the Pacific North-west for a number of years, was doubtless confused with yellows (xanthosis) in western Oregon and Washington as early as 1925 [*R.A.M.*, xi, p. 497]. The disease is most severe under the cool, humid conditions prevailing along the coast or a short distance inland, the Marshall variety expressing its characteristic symptoms in a particularly well-defined manner. In addition to the pronounced dwarfing of the affected clones, which are two or three times shorter than healthy ones, the under sides of the leaves show a dull grey tone, similar to that imparted by mildew [*Sphaerotheca humuli*], but otherwise there is surprisingly little reduction of chlorophyll. The growth habit of stunted plants is moderately erect in contrast to the flatness of those suffering from xanthosis or severe crinkle. The leaves are erect and folded along each midvein, which may be somewhat tortuous, until the full length of the petiole is attained, whereupon they open out to expose a flat, dull upper surface. The stunted leaflets may be cupped, especially in some of the thick, dark-leaved varieties, but more often the margins turn downwards; at maturity they make a rattling, papery sound on brushing by hand. The fruit from diseased plants is small, and usually seedy and hard. The disturbance would appear to be more closely related to witches' broom [ibid., xviii, p. 402] than to any other strawberry virus.

'Stunt' is readily transmissible from diseased Marshall plants and U.S.D.A. seedlings to healthy Marshalls by means of the aphid *Capitophorus fragaefolii*. In one instance evidence was forthcoming of dual infection by stunt and crinkle in the William Belt variety, the latter condition being completely masked while the symptoms of the former were atypical.

'Stunt' is proposed as the common name for the disease under investigation, which is scientifically designated *Fragaria* virus 5, or to adopt the Holmes system of virus classification [ibid., xix, p. 229], *Nanus cupuliformans*.

TIMS (E. C.). **A new leaf spot of Fig.**—Abs. in *Phytopathology*, xxxi, 8, p. 771, 1941.

A single fig tree of the Celeste variety near Houma, Louisiana, was attacked in the late summers of 1939 and 1940 by a fungus tentatively identified as *Cephalosporium acremonium*, which produces on the foliage light brown, darker-bordered spots, irregularly concentrically zonate on the upper surface and bearing on the lower one numerous small, white, cushion-like fruiting bodies of the pathogen. The centres of the larger lesions (4 to 5 cm. in diameter) often fall out, imparting a very ragged aspect to the leaves. Inoculation experiments with the causal organism under warm, humid conditions resulted in the development of rapidly expanding spots. Wounds do not appear to be necessary for the establishment of leaf infection. Severe damage from the new disease is not anticipated, owing to its late development after the ripening of the bulk of the fruit.

MAGEE (C. J.). **Control of squirter and black-end diseases of Bananas.**—*Banana Bull., Sydney*, i, 60, p. 4, 1941.

In connexion with recommendations for the control of banana squirter (*Nigrospora sphaerica*) and black end (*N. sphaerica*, *Gloeosporium musarum*, and *Fusarium* spp.) by dipping the fruit in a salicylanilide solution after packing, the writer mentions that, in addition to shirlan AG and shirlan WS [*R.A.M.*, xix, p. 106], a third preparation is now available on the market known as shirlan flakes, in which sodium salicylanilide is combined with a wetting agent. In dipping the fruit, care should be taken to dislodge airlocks in papered cases by raising and lowering the case a few times by means of a loop or rope or a pulley block and tackle. Suitable dimensions for a vat for this purpose are 15 in. deep, 13½ in. and 17½ in. wide at the ends and middle, respectively, and 32 in. long. The duration of the dip need not exceed ½ minute, and the treatment should constitute a routine procedure from May to November, especially for fruit destined for the Adelaide or Melbourne markets.

HOPKINS (J. C. F.). **Diseases of fruit, flowers, and vegetables in Southern Rhodesia. 4, Mildew of Mangoes.**—*Rhod. agric. J.*, xxxviii, 9, pp. 470–471, 1941.

Substantial losses of yield are caused to mango growers in Southern Rhodesia as a result of blossom infection by mildew (*Oidium* sp.) [?*O. mangiferae*: *R.A.M.*, xx, p. 413], which is frequently overlooked until it is too late to apply remedial measures. The flowers may fail to open and may drop before being fertilized, or the young fruits may reach the size of a pea and then fall. In the more humid parts of the Colony, especially on the eastern border, the fungus may develop abundantly on the new leaves. Infection occurs every year, severity depending chiefly on climatic conditions. Control consists in the application of fine sulphur dusts when the flower clusters have expanded (just before the flowers open), immediately after petal fall, and when the young fruits are the size of buckshot. Wet spraying with colloidal sulphur (1 lb. per 30 gals. water) also gives satisfactory results.

WILSON (J. D.) & VOGEL (M. A.). **Density and flowability of insecticidal and fungicidal dusts and dust ingredients.**—*Bi-m. Bull. Ohio agric. Exp. Sta.*, xxvi, 209, pp. 69–79, 1941.

In preliminary studies at the Ohio Agricultural Experiment Station the copper content (stated as the metallic equivalent) of a number of fixed copper compounds [*R.A.M.*, xx, p. 2] tested for their degrees of density and 'flowability' (defined as the rate of passage of a compound or mixture through the feed aperture of a dusting apparatus, the Peerless hand duster in this case) ranged from 86 per cent. for cuprocide GA (Röhm and Haas Co.) to 23 per cent. for copper oxalate (Harshaw Chemical Co.). Density (expressed as gm. per cu. in. and determined by means of a Scott volumeter) varied between 16 for cuprocide GA and 2·67 for copper oxychloride sulphate (Harshaw); this property is not exclusively a function of size, since yellow cuprocide, with extremely minute particles, has a density of 11·5 gm. 'Flowability' under a standard set of conditions ranged from 2·10 lb. per minute for cupro-K (Röhm and Haas) to 0·49 lb. for coposil (California Spray Chemical Co.). When the different compounds were mixed with Avondale wheat flour (Kroger Baking Co.) and EM 23 talc (Eastern Magnesia Talc Co.), the densities of the mixtures varied only from 7·22 for that containing cuprocide GA to 6·22 for the one made up with coposil, whereas the use of flour and EM 42 talc involved variations of up to 200 per cent., ranging from 1·87 lb. with cuprocide GA to 0·84 lb. with coposil.

Among the diluents included in the experiments, the density of the talcs ranged from 2·70 gm. for EM 29 to 9·68 for EM 42, while that of the clays varied only within narrow limits—4·26 gm. for Tower and 5·45 for Cherokee (both United Clay Mines Corporation). The gypsums and whitings are comparatively heavy (6·53 to 10·58 gm.) unless ground to excessively fine particle size. The least dense of the common diluent materials were diatomaceous (infusorial) earth and its variants, dicalite and celite (Chemical Rubber Co., Dicalite Co., and Johns-Manville Co., respectively), with densities of 2·43, 1·48, and 1·43 gm., respectively. Of the adhesives used in the tests, the density of the bentonites ranged from 4·61 for micronized to 10·25 for Wyobard (both Wyodak Chemical Co.) and that of the wheat flours from 3·81 for a soft blend to 5·45 for Family Circle (both Pilsbury Flour Mills Co.), while that of the one sample of soy-bean flour (duspray soya, Central Soya Co.) was 6·21. The diluents influence the density and 'flowability' of the mixed dust formulas more than do the copper compounds, being used in larger proportions. When the proportions of light and heavy diluents were varied in a single formula to yield mixtures of different densities and rates of flow, density was found to decrease steadily and fairly uniformly with each increase in the lighter diluent, whereas 'flowability' underwent little change provided the amount of low-density diluent was not less than 20 per cent. of the total mixture.

Proprietary dust mixtures available on the market varied in density between 9·80 and 4·88 gm. per cu. in., and in 'flowability' from 2·70 to 0·80 lb. per minute.

**Stationary spray plant.**—*Fruit World, Melbourne*, xlii, 8, p. 11, 1 fig., 1941.

The owners of a 40-acre orchard of 31-year-old pear trees in Victoria

report that after three years' continuous service their stationary spray installation [cf. *R.A.M.*, xix, p. 295; xx, p. 265] has proved completely satisfactory. Using 1 pump and 7 men it covers the whole area in 7 days, as against 16 days required for a portable plant using 4 pumps and 8 men. One great advantage is that it permits spraying to be interrupted or resumed immediately, as required. The cost of installation amounts to approximately £13 per acre.

McLean (R. C.) & Cook (W. R. I.). **Plant science formulae. A reference book for plant science laboratories (including bacteriology).**—viii+203 pp., London, Macmillan & Co., 1941. 7*s*. 6*d*.

This book contains much information useful to the laboratory worker. The formulae are of proved and established worth, and include a number for special fixing and preserving solutions, stains, solid and liquid culture media.

Hamly (D. H.). **A precision fine adjustment for standard microscopes.**—*Science*, N.S., xciv, 2437, pp. 263–264, 1941.

The author describes an attachment for use with a standard microscope making it possible to obtain a series of photomicrographs showing all the changes in appearance produced by progressive refocusing.

Ehrlich (J.). **Storage and mounting of demonstration specimens.**—*Phytopathology*, xxxi, 8, pp. 763–766, 1 diag., 1941.

Full details are given of the construction of a cabinet accommodating a series of wooden drawers of four sizes, which has been specially devised for the storage of large, heavy, or fragile demonstration specimens in the pathological laboratory of the School of Forestry, Moscow, Idaho.

Edson (H. A.) & Wood (Jessie I.). **Crop losses from plant diseases in the United States in 1939.**—*Plant Dis. Reptr, Suppl.* 127, pp. 178–209, 1940 (issued June, 1941).

The estimated reductions from fungal, bacterial, virus, and other diseases of fruit, vegetable, cereal, tomato, and tobacco crops in the United States in 1939 are presented in tabular form [cf. *R.A.M.*, xix, p. 357].

Dodd (A. P.). **The biological campaign against Prickly-Pear.**—ii+117 pp., 37 pl. (1 col.), 6 graphs, 1 map (col.), Brisbane, Commonwealth Prickly Pear Board, 1940.

This striking record of the successful campaign waged against prickly pears (*Opuntia* spp., chiefly *O. inermis* and *O. stricta*) in Australia by the Commonwealth Prickly Pear Board from 1920 to 1940 [cf. *R.A.M.*, v, p. 303] contains the following items of mycological interest.

The anthracnose fungi *Gloeosporium lunatum* [ibid., xviii, p. 810] and *Phyllosticta concava* [ibid., xvii, p. 461] are established in Australia, but *Montagnella opuntiarum* [ibid., v, p. 303] has not been found. *G. lunatum* occurred in 1925–6 in several widely separated areas, where it had probably become established some years before. Locally, the circular lesion character is seldom found. As a primary parasite the

fungus occurs chiefly in nitrogen-deficient plants known as 'yellow pear', being often active round the entrance holes of newly hatched larvae of *Cactoblastis cactorum*, the chief agent of control. In many instances it is associated with these larvae as a wound organism in the rapid decay of succulent segments, the decay set up taking the form of a soft rot.

The most conspicuous anthracnose is that due to *P. concava*. First found in 1929, the fungus occurs over the whole of the prickly pear territory, from Mackay to the Hunter River. The disease begins in May or June, reaches a peak in July and August, and ceases in September or October. Save in central Queensland, where the fungus is very active each season, destroying many segments, and the northern pear areas of the same State, occurrence is not general, but confined to local outbreaks in situations favouring attack. At the close of winter damage is marked but transitory, as fungal activity ceases as the weather grows warmer, and new growth takes place. Very occasionally, young plants in shaded situations have been destroyed by the fungus. Lesions due to *P. concava* have been observed on *O. aurantiaca* and very rarely on *O. tomentosa*.

Locally, bacterial soft rot or rots accompany the activities of *C. cactorum* in the upper segments of the host. Complete disintegration is not induced by bacterial activity, except in the case of young plants. The organism is carried on the skin of the larvae, and spreads from one segment to another only if carried by the insects. The disease takes the form of a liquid putrefaction of the pads. Activity occurs when the larvae are feeding vigorously, but even at these times bacterial soft rots require favourable weather conditions before they develop.

From 1929 to 1931 the winter generations of *C. cactorum* attacking primary pear in Queensland and New South Wales suffered severe losses as a result of epidemic attacks by bacteria and a species of *Beauveria*. At least seven bacterial organisms found were able to cause the death of the insect when inoculated into the blood stream, though the losses appeared mainly due to two species of *Coccobacillus* and one *Streptococcus*. The *Beauveria* fungus destroyed individual larvae and entire colonies, as many as 200 dead, infected larvae being found in one segment. The fungus did not occur in epidemic form over large areas, except in one instance, in which it appeared to be the principal cause of a heavy death rate among a concentrated population over an area of several square miles. It was transmitted to healthy larvae by feeding them on prickly pear contaminated by the spores, fatal results ensuing within seven days. Evidence was obtained that two factors are essential before organisms pathogenic to the insects can become important, viz., the larvae must be crowded, and their food supply unsuitable. Since 1933 there has been no record of bacterial disease on *Cactoblastis*, and only one of *Beauveria*, which occurred in a small area in July, 1938.

Plotho (O. v.). **Die Synthese der Knöllchen an den Wurzeln der Erle.** [Nodule synthesis on Alder roots.]—*Arch. Mikrobiol.*, xii, 1, pp. 1–18, 4 figs., 1941.

At the Microbiological Institute, Göttingen, the causal organism,

*Actinomyces alni*, of the root excrescences on alder (*Alnus incana*) [*R.A.M.*, xviii, p. 335] was isolated on various media, of which the most suitable proved to be a meat extract-peptone agar, and inoculated with positive results into *A. glutinosa* plants germinated under sterile conditions and grown in a nutrient solution devoid of nitrogen except for the traces contained in the tap water used to prepare the *Actinomyces* spore suspension. Well-developed plants were found in September 1940, i.e., 15 months after inoculation, to have assimilated from the atmosphere 63·44 mg. nitrogen, obviously fixed by the symbiont, the nitrogen content of the shoots and leaves being 45·22 mg. and that of the roots and nodules 22·06 mg. The abundant deposits of carbohydrates in the nodules and adjacent root cells are believed to be connected with nitrogen assimilation. Bacteroids were not observed, the spread of the endophyte being effected by progressive development in the root cells of the host.

STEINBERG (R. A.). **Sulfur and trace-element nutrition of Aspergillus niger.**—*J. agric. Res.*, lxiii, 2, pp. 109–127, 1941.

This is a detailed study on the sulphur metabolism of *Aspergillus niger*, in the course of which it is shown that alterations in the source of sulphur supply remain practically without effect on the trace element requirements of this fungus.

KENT (N. L.). **The influence of lithium salts on certain cultivated plants and their parasitic diseases.**—*Ann. appl. Biol.*, xxviii, 3, pp. 189–209, 3 graphs, 1941.

In greenhouse experiments at Cambridge on the effect of lithium on the susceptibility of plants to disease [cf. *R.A.M.*, vi, p. 628; ix, p. 100; xiii, p. 459], the incidence of leaf spot caused by *Septoria apii* on celery was reduced by lithium chloride and nitrate at concentrations between 1 and 4 mg.-equiv. Li/l. soil applied to the surface of the soil and the weight of the host plants was increased, the intensity of disease on plants 36 days after treatment with 4·8 mg.-equiv. LiCl/l. soil being as follows: on the cotyledons 57 per cent., primary disease on the leaves 40 per cent., and secondary disease 1·4 per cent. of that on the controls; larger concentrations, though more effective, were toxic to plant tissue. The lithium content of the plant was increased following the application of lithium to the soil. A high inverse correlation was found to exist between the concentration of lithium in the celery leaves and the amount of disease present.

The susceptibility of wheat seedlings to powdery mildew (*Erysiphe graminis*) was generally reduced by lithium chloride and nitrate, the addition of 18·35 mg. Li/l. soil as chloride reducing the relative disease intensity from 100 in the controls to 15; small doses had a stimulating and large doses a retarding effect upon the growth of the seedlings. All the concentrations tested increased the lithium content of the plant tops. Significant inverse correlations were found to exist between relative mildew intensity and both the lithium supply in the soil and the concentration of lithium in the fresh plant material.

The susceptibility of young wheat plants to brown rust, *Puccinia triticina*, was significantly reduced by lithium chloride applications at

the rate of 18 mg.-equiv./l. soil, a concentration which was distinctly toxic to the plants, reducing their dry-weight yield to less than half that of the untreated control plants. Smaller concentrations had no noticeable effect upon the disease.

Application of lithium nitrate at the rate of 2·5 mg.-equiv./l. soil significantly reduced the diameter and weight of crown galls (*Bacterium tumefaciens*) of tomato. An increase in the fresh weight of the plants treated with lithium chloride over that of untreated plants was noticed 17 weeks after application. The effect of lithium nitrate on yield was negligible. There was a close relationship between the lithium concentration present in the galls and that applied, and a high inverse correlation between gall weight and the concentration of lithium in the gall. A considerable quantity of lithium was excreted from the treated plants in the leaves which fell prematurely.

Bose (S. R.). **The nature of the colouring substances in coloured Polyporaceae.**—*Trans. nat. Inst. Sci. India*, ii, 3, pp. 69–85, 4 pl. (2 col.), 1941.

In malt agar cultures of 13 coloured Polyporaceae, including *Polyporus zonalis*, *P. rubidus*, *Polystictus hirsutus*, *P. versicolor*, *P. sanguineus*, *Trametes persoonii*, and *Ganoderma lucidum*, the specific tints were observed in all cases to develop on the walls of the dead hyphae, either as a general staining substance or in the form of densely agglomerated pigment granules; living hyphae did not assume the coloration. The stain may serve a protective purpose, forming a cuticular covering for the hyphae within. The colouring matter of all the species was soluble in water, and (with the exception of *P. versicolor*) also in alcohol. Light apparently exerts no direct influence on colour production by the Polyporaceae.

A vacuolar stain of a very pale shade of pink (Hermosa of Ridgway), visible only under the oil immersion lens, occurs in the living hyphae both of coloured and white fungi of different groups and appears to be closely associated with metabolic processes.

Tilford (P. E.). **Ohio Potato diseases.**—*Bull. Ohio agric. Exp. Sta.* 615, 35 pp., 28 figs., 1940.

This bulletin, superseding No. 432 in the same series (1929) [*R.A.M.*, ix, p. 51], incorporates information accumulated since that date with the facts previously presented.

Black (L. M.). **Specific transmission of varieties of Potato yellow-dwarf virus by related insects.**—*Amer. Potato J.*, xviii, 8, pp. 231–233, 1941.

During each of the three past years, leafhoppers of the species *Agallia constricta* van Duzee (closely related to, but distinct from, *Aceratagallia sanguinolenta*, according to P. W. Oman in *Tech. Bull. U.S. Dep. Agric.* 372, 1933) collected in New Jersey were found to be carrying a strain of the potato yellow dwarf virus differing from the New York form in the symptoms produced on Green Mountain potatoes, crimson clover (*Trifolium incarnatum*), *Nicotiana rustica*, and *N. glutinosa*. Thus, on clover, the New Jersey strain, which it is pro-

posed to name *Marmor vastans* H. var. *agalliae* n. var., causes a rusty-brown necrosis of the veins and yellowing, chiefly of the older leaves, in contrast to the typical vein-clearing and chlorosis of the younger foliage associated with the New York form of the disease. Both on clover and *N. rustica* the New Jersey strain was much less invasive than that from New York. The high degree of specificity, possibly absolute, existing in the relationship between the two virus varieties and the two allied leafhoppers was illustrated by inoculation experiments on crimson clover, in which the New York strain was transmitted only by *A. sanguinolenta* and the New Jersey form exclusively by *Agallia constricta*. In two experiments the New Jersey strain protected *N. rustica* plants against the *lethale* variety of the New York virus [*R.A.M.*, xix, p. 725], which induced typical systemic symptoms of necrosis on the controls, consisting of some healthy plants and others inoculated with the unrelated viruses of tobacco ring spot and streak and potato calico.

Plummer (B. E.) & Bonde (R.). **Some relations between mercuric chloride content, acid content, and fungicidal efficiency of certain solutions as used for Potato tuber disinfection.**—*Phytopathology*, xxxi, 9, pp. 812–817, 1941.

The general reluctance of farmers to apply the mercuric chloride treatment for the control of the *Rhizoctonia* disease of potato tubers (*Corticium vagum*) [*C. solani*] in the United States is attributed largely to the tedious and complicated nature of the method. A series of trials was therefore conducted from 1937 to 1939 at the Maine Agricultural Experiment Station with a view to additional simplification and enhanced efficacy.

In laboratory tests the rapid lowering of the mercuric chloride concentration through successive treatments of unwashed potato tubers was appreciably retarded by curtailing the duration of each treatment from 90 to 10 minutes and by acidulating the solution with hydrochloric acid at the rate of 0·2 per cent. by weight, but not by reducing the length of each immersion in the acidulated solution. The reduction of mercuric chloride concentration in the acidulated solution was not affected by the use of hard rather than distilled water as a solvent. The turbidity of the treating solution was considerably reduced by acidulation. The acid was depleted more rapidly than the salt in the same solution. Similarly, in field trials the rapid lowering of the mercuric chloride concentration and consequent decline in the efficiency of control of *C. solani* were retarded by acidulation with hydrochloric or acetic acid (0·555 or 1·66 per cent. by volume), the latter being much more slowly depleted than the former and having the further advantage of being less injurious to human skin and clothing. As in the laboratory tests, acidulation reduced the turbidity of the solutions. Acidulation renders the mercuric chloride solution effective for 25 successive treatments, and in field trials in 1938 and 1939 the average percentages of clean plants for a series of 25 five-minute treatments in a mercuric chloride solution acidulated with hydrochloric acid were 74·2 and 88·4, respectively; in the latter year both the hydrochloric acid and mercuric chloride concentrations were higher than in

the former. The average percentage of clean plants for 25 five-minute dips in a mercuric chloride solution acidulated with acetic acid in 1939 was 88·7, though the mercuric chloride concentration was lower than in the solution acidified with hydrochloric acid in the same year.

GRÜTTE (E.). **Rhizoctonia solani K. als Schädling der Kartoffelknolle.** [*Rhizoctonia solani* K. as a pathogen of the Potato tuber.]—*Z. PflKrankh.*, l, pp. 225–230, 1940. [Abs. in *Zbl. Bakt.*, Abt. 2, ciii, 21–24, p. 412, 1941.]

Field observations on the occurrence of the potato tuber rot caused by *Rhizoctonia* [*Corticium*] *solani* [in Germany] are described. The incidence of infection, which is expressed by the formation of more or less deeply sunken, dry lesions surrounded by suberized tissues, varies with the variety and soil constitution, crops planted on clay soils suffering more severely than those on the lighter types. No isolation of the fungus was made.

LUTMAN (B. F.). **Actinomyces in Potato tubers.**—*Phytopathology*, xxxi, 8, pp. 702–717, 9 figs., 1941.

Studies at the Vermont Agricultural Experiment Station on the infection of Green Mountain potato tubers by *Actinomyces scabies* disclosed that infected lenticels (stained by a modification of the Gram technique described in *Stain Tech.*, xvi, pp. 63–66, 1941) showed guard cells surrounded by enlarged cells with thickened and browned walls presenting a wavy outline in section due to the presence of the pathogen, which generally appears to penetrate through the middle lamella, splitting the walls apart. In addition to infected lenticels patches of brown schizogenic spaces were visible, with *Actinomyces* filaments in the dark jelly filling the spaces. Infection apparently occurs, not only through the stomata and lenticels [*R.A.M.*, xix, p. 112], but also through any place on the skin where two cells join in the case of very small tubers (0·5 to 1 cm. in diameter). The hyphae of the fungus occupy the inside of the cell walls of the whole tuber, extending from the outer layer of cork to the centre. On a pectin jelly medium [ibid., iii, p. 198], two formulae for the composition of which are given, a chromogenic strain of *A. scabies* isolated from infected soil formed a profusion of white, flocculent colonies with numerous conidia and liquefied the medium. Bits of infected tuber tissue gave no growth of *Actinomyces* on these media, due, it is suspected, to the intimate relationship existing between host and parasite.

KRANTZ (F. A.) & EIDE (C. J.). **Inheritance of reaction to common scab in the Potato.**—*J. agric. Res.*, lxiii, 4, pp. 219–231, 1941.

In field and greenhouse breeding studies in Minnesota the sexual progeny of 14 $F_1$, 32 $F_2$, and 18 $F_3$ segregates of the cross between the potato varieties Accession 123 (an unidentified clone obtained as a rogue in a field of Irish Cobblers) and Lookout Mountain were tested for reaction to common scab (*Actinomyces scabies*) [*R.A.M.*, xix, p. 42]. Assuming that the potato is an autotetraploid and the difference observed in reaction to common scab is principally due to the influence of one gene, the segregates were classified into five genetic groups

corresponding to breeding types designated as $Sc_4$, $Sc_3sc$, $Sc_2sc_2$, $Scsc_3$, and $sc_4$, separated in regions where the mean scab reaction of the sexual progenies showed the greatest discontinuity. One hundred and eighteen varieties and selections of heterogeneous origin were classified into these five groups as follows: type 1—the variety Hindenburg; type 2—seven selections and the variety Jubel; type 3—42 selections; type 4—31 selections and the variety Earlaine; and type 5—34 selections and the variety Chippewa. Hindenburg gave a progeny from which two segregates were isolated whose sexual progeny gave a significantly higher mean scab reaction than the progeny of Hindenburg. Crosses between types gave progenies whose mean reaction to scab was in general agreement with the reaction of the selfed progenies of the parents. Varieties Early Ohio, Triumph, and Warba were classified in type 5, from the mean scab reaction of the crossed progenies, obtained when these varieties were used as female parents. In a study of 13 crosses an association was found to exist between the colour factor P and the mean scab reaction; the mean scab reaction of the P and p plants for the 13 crosses was 2·49 and 1·99, respectively.

Goss (R. W.) & Jensen (J. H.). **Varietal susceptibility of Potatoes to Fusarium wilt.**—*Amer. Potato J.*, xviii, 7, pp. 209–212, 1941.

A tabulated account is given of a series of tests of varietal reaction to *Fusarium* wilt in potatoes conducted in 1939 and 1940 as part of the Nebraska breeding programme. In these two years inoculum of *F. solani* var. *eumartii* [*R.A.M.*, xix, p. 491] was added at the rate of ½ lb. per ft. of row just before planting, but the field had already been planted with severely infected seed tubers in 1936 and kept continuously under potatoes since that time. More than 90 per cent. of the foliar symptoms and practically all those of the tubers were characteristic of *F. solani* var. *eumartii*, the agent of stem-end rot and vascular discoloration of the tubers, though *F. solani* and *F. oxysporum* were also present in the field. In both years the Pontiac, Katahdin, Golden, and Sebago varieties and two hybrids, B 5 and B 4–1 (Minn. 1. 33–1–34 and Minn. 29. 32–1–34) proved to be highly resistant, with infection percentages in 1939 of 0·6, 2·2, 2·6, 0·8, 1·5, and 0·9, respectively, and in 1940 (a season of much greater severity of the pathogen), 7, 7, 5·5, 7·3, 4, and 6, respectively. White Rose, Earlaine, and Chippewa were much more susceptible, while Mesaba and Warba sustained even heavier damage than the Irish Cobbler and Bliss Triumph controls. Of the four German varieties included in the tests but not tabulated, Hindenburg and Jubel were highly resistant, Arnica about on a level with the best American varieties, and Erstling [Duke of York] equally susceptible with Irish Cobbler and Bliss Triumph.

Jensen (J. H.) & Goss (R. W.). **Infection of first-year Potato seedlings with Fusarium solani var. eumartii.**—*Amer. Potato J.*, xviii, 8, pp. 239–242, 1941.

The testing of first-year seedlings for resistance to *Fusarium solani* var. *eumartii* in the greenhouse has proved to be an effective method of eliminating susceptible individuals at the Nebraska Agricultural Experiment Station [see preceding abstract]. This practice obviates

the disadvantage of the high cost of growing plants from tubers and reduces the large number of escapes apt to occur in the field. The symptoms of the disease, which appear about a month after transplanting, are as clearly defined in the seedlings as in plants raised from tubers, and the results of the limited tests to date indicate that the desirability of parent stock for breeding purposes can be readily determined by the new method. In an experiment in which 341 seedlings from six different crosses were planted in inoculated sterilized soil, 250 became infected and 91 remained healthy. In a second-year test of 33 surviving clones (130 plants) in inoculated non-sterilized soil, 26 contracted the disease and 7 remained healthy, while in the third year in the field, eleven out of twelve clones (53 plants) were sound, only one of the 221 tubers produced showing vascular discoloration.

TIPOGRAF (D. Y.). Ускоренный способ обнаружения кольцевой гнили Картофеля. [A rapid method of diagnosing ring rot of Potato.]—*C.R. Pan-Sov. V.I. Lenin Acad. agric. Sci., Moscow, 1941*, 5, pp. 35–38, 1 fig., 1941.

The author describes an accurate and quick method (requiring two to three minutes) of diagnosing potato ring rot (*Bacterium sepedonicum*) [*R.A.M.*, xx, p. 419]. It consists in an agglutination test in which plant juice from a diseased stem or tuber is mixed with (1) immune serum obtained by injecting a pure culture suspension of *Bact. sepedonicum* into rabbits and (2) normal serum; in case of a positive reaction the drop containing the immune serum becomes flocculent and lighter in colour, while the drop with the normal serum used as a control remains turbid. In parallel tests the results obtained by means of the microscope in most cases entirely coincided with the serological data, but sometimes remained somewhat indefinite. In tests of the specificity of the immune serum it was found that 59 out of 60 strains of bacteria isolated from potatoes affected by ring rot yielded clearly negative results and the remaining strain induced an indefinite reaction. Application of the serological method in the field showed that 22·9 per cent. of apparently healthy, well-developed plants were infected, and it is concluded, therefore, that appraisal of healthy plants by external appearance only does not offer sufficient guarantee against the presence of ring rot. Stems containing *Bact. sepedonicum*, when dried at room temperature, retained their capacity to agglutinate after 100 days of storage; pure cultures of the organism retained theirs after being dried at 80° C. for 50 minutes. This shows that the serological method of diagnosis can be made with both fresh and dried stems of the potato.

WERNER (H. O.) & DUTT (J. O.). **Reduction of cracking of late crop Potatoes at harvest time by root cutting or vine killing.**—*Amer. Potato J.*, xviii, 7, pp. 189–208, 5 figs., 3 graphs, 1941.

Cracking of the tubers at harvest time is stated to be the most serious grade defect ordinarily encountered by growers of late-crop Bliss Triumph potatoes in the northern high plains. Investigations at the Nebraska Agricultural Experiment Station showed the condition to be probably due to a great increase in turgidity resulting from a sharp reduction of transpiration while the roots are well supplied with mois-

ture, or from an abrupt increase in soil moisture following a dry spell and coinciding with a slow transpiration rate [cf. *R.A.M.*, xx, p. 377]. Root-cutting by means of a modified potato digger blade effectively diminished the incidence of cracking, the action of a killing spray (3 per cent. elgetol extra) on the aerial portions of the plants being slower and less extensive. Root-cutting gave less reliable results in wet soils and on over-mature plants, the high turgidity of the tubers in such cases being apparently maintained by direct absorption of water through the skin, and some loosening of the soil to promote drying-out is therefore advisable. The amount of cracking fluctuated from day to day and throughout a given day, increasing overnight or during cold and overcast periods and declining in bright or windy weather. Bliss Triumph and Pontiac tubers were found to be the most susceptible to cracking, while Mesaba and Warba were less susceptible, and Irish Cobbler, Chippewa, and Katahdin were virtually immune from the trouble.

Robinson (Ursula M.). **Blackening of Potato tubers on boiling.**—*Nature, Lond.*, cxlvii, 3738, pp. 777–778, 1941.

The author points out that the black coloration which develops in some potato tubers after boiling [*R.A.M.*, xv, p. 526] cannot be due to the presence of melanin, as it disappears in acid solution at about $P_H$ 3, at which value melanin is stable. Estimation of the iron content of numerous tubers revealed a marked correlation between this and the incidence of blackening, the tubers which developed the discoloration all containing more iron than those which remained normal. Almost all of the extractable iron appeared to be in the ferrous state. It is tentatively suggested that in raw tubers the precursor of the black pigment exists in the form of ferrous iron bound in a loose complex, possibly in combination with proteins. This complex is hydrolysed on boiling, and the iron is then precipitated as a colourless ferrous compound, probably the hydroxide, which is gradually oxidized to the black oxide as air reaches the tissues.

Cowie (G. A.). **Blackening of Potato tubers on boiling.**—*Nature, Lond.*, cxlviii, 3749, pp. 285–286, 1941.

From an examination of samples obtained from approximately 40 modern replicated fertilizer experiments the author found that the typical grey to black discoloration that develops in potatoes after boiling [see preceding abstract] was confined to tubers grown on plots deficient in potash, but with a relatively high nitrogen level in the soil. It has been shown by various workers that in potash-starved plants the amino acids increase relatively to the protein, owing, in part at least, to the breakdown of protein. These changes may result in an abnormal distribution of iron in the plants and a higher concentration in potato tubers. Hoffer (*Bull. Ind. agric. Exp. Sta.* 298, 1930) has shown that maize plants grown under conditions of potash deficiency accumulate iron compounds in the nodes and the potassium content in relation to the iron content of tubers that blacken on boiling is therefore of particular interest.

DE JONG (W. H.). **Over de bestrijding van eenige ziekten, die houtwonden aan het onderste deel van den stam van Hevea veroorzaken.** [On the control of some diseases causing wood injuries on the stem base of *Hevea*.]—*Bergcultures*, xv, 33, pp. 1134–1137, 1941.

Previous recommendations for the control of collar rots of *Hevea* rubber trees in the Dutch East Indies are summarized and discussed in the light of the author's experience. Three distinct types of decay are recognized, caused by (*a*) *Phytophthora* and *Pythium* spp., (*b*) *Ustulina zonata*, and (*c*) *Rosellinia bunodes*. Treatment for cankers of the first-named type necessitates the careful removal of the diseased bark, trimming of the wound, and the application to the exposed areas of a strong antiseptic, e.g., 10 per cent. carbolineum plantarum, but the bark should not be scraped unless the black film produced by *Diplodia* [*Botryodiplodia theobromae*] has to be removed. The cut surface, when thoroughly dry, is covered, e.g., with asphalt B.P.M. 20/30, an external coating of whitewash also being applied in regions with a well-marked dry season. The wounds should be inspected once or twice a year to ascertain that callus formation is proceeding normally. Drastic excisions are indicated in the case of *U. zonata*, which is a true wood parasite, followed by annual applications of tar to the wounds.

In the case of *R. bunodes* infected wood should be removed, the wounds treated, and recurrences of the attack forestalled by the eradication of suckers and clearing of the ground surrounding the trees—an important measure also in the control of cankers.

In the treatment of cankers, the writer cannot, at any rate without further investigation, endorse the methods now being advocated which entail the excision of the discoloured wood. It is true that the xylem cells are occupied by fungal elements, but these are in no sense parasitic on the wood, though they might possibly weaken it and so pave the way for more aggressive pathogens. Examples of this kind, however, have not come within the author's experience.

**Hunger signs in crops: a symposium.**—xiii+327 pp., 79 col. pl., 94 figs., 1 graph, Washington, D.C., The American Society of Agronomy and The National Fertilizer Association, 1941. $2.

The scope of this valuable manual may be illustrated by the headings of the nine chapters (each followed by a bibliography) into which it is divided, viz., (I) Why do plants starve? by G. D. Scarseth and R. M. Salter; (II) Plant-nutrient deficiency in tobacco by J. E. McMurtrey; (III) Deficiency symptoms of corn and small grains by G. N. Hoffer; (IV) Plant-nutrient deficiency symptoms in the potato by H. A. Jones and B. E. Brown; (V) Plant-nutrient deficiency symptoms in cotton by H. P. Cooper; (VI) Plant-nutrient deficiencies in vegetable or truck-crop plants by J. J. Skinner; (VII) Nutrient-deficiency symptoms in deciduous fruits by O. W. Davidson; (VIII) Plant-nutrient deficiency symptoms in legumes by E. E. De Turk; (IX) Symptoms of citrus malnutrition by A. F. Camp, H. D. Chapman, G. M. Bahrt, and E. R. Parker. The foreword explaining the origin and purpose of the work is by G. Hambidge. Special mention should be made of the excellent coloured plates and black-and-white figures designed to assist in the

rapid identification of the various disorders associated with the lack of essential nutritive elements.

Drake (M.), Sibling (D. H.), & Scarseth (G. D.). **Calcium-boron ratio as an important factor in controlling the boron starvation of plants.**—*J. Amer. Soc. Agron.*, xxxiii, 5, pp. 454–462, 1 fig., 1941.

In experiments at the Indiana Agricultural Experiment Station the growth of Turkish tobacco on a Norfolk sand in greenhouse pots appeared normal when the calcium-boron ratio in the plants did not exceed 1,340 : 1, whereas severe boron starvation symptoms developed in those with a calcium-boron ratio of 1,500 : 1. These results, taken in conjunction with those of other workers, denote that boron starvation occurs as a sequel to an unfavourable calcium-boron ratio.

Atwater (C. G.). **The ancient history of boron deficiency symptoms.**—*J. Amer. Soc. Agron.*, xxxiii, 10, pp. 939–942, 1941.

The writer briefly summarizes the literature on some diseases of agricultural crops formerly attributed to a variety of causes but now recognized to be associated with boron deficiency and curable by the application of this element to the soil in an appropriate form.

Carlyle (R. E.) & Norman (A. G.). **Microbial thermogenesis in the decomposition of plant materials. Part II. Factors involved.**—*J. Bact.*, xli, 6, pp. 699–724, 13 graphs, 1941.

In the course of studies at the Iowa Agricultural Experiment Station on microbial thermogenesis in relation to the decomposition of plant materials [*R.A.M.*, xiv, p. 55], the writers carried out experiments with pure cultures of *Aspergillus fumigatus* in a specially constructed fermentation vessel referred to as the adiabiatic apparatus [which is fully described in a previous paper: Part I of the same series, in *J. Bact.*, xli, 6, pp. 689–697, 2 diags., 1941]. The mould raised the temperature of the inoculated oats straw from 25° to nearly 55° C. in 38 hours, with a peak rate of 2·3° per hour at 40·7°.

Wedberg (S. E.) & Rettger (L. F.). **Factors influencing microbial thermogenesis.**—*J. Bact.*, xli, 6, pp. 725–743, 1941.

During preliminary heating experiments at Yale University, New Haven, Connecticut, with unsterilized maize, the writers isolated in pure culture three moulds, viz., *Rhizopus mucor* and two species of *Aspergillus* [cf. preceding abstract], one green and the other brown, all of which made luxuriant growth in 48 hours at room temperature on 3 per cent. maize extract agar. To determine the thermogenetic capabilities of these fungi, each was inoculated into an appropriate amount of glucose broth ($P_H$ 6), and after 24 hours' incubation at room temperature the cultures were applied to sterile maize in insulated Dewar flasks with an oxygen aeration system (L. H. James, Microbial thermogenesis, Dissertation Yale Univ., 1927), bringing the moisture content of the substratum up to 30 per cent. Within three days temperatures of 57°, 53°, and 55·5° C. were attained with the cultures of *R. mucor* and the brown and green species of *Aspergillus*, respectively.

Nusbaum (C. J.). **The role of hot water seed treatment in the control of Cercospora blight of Benne.**—Abs. in *Phytopathology*, xxxi, 8, p. 770, 1941.

In 1939 the benne (*Sesamum indicum*) crop in the coastal region of South Carolina, where it is widely grown as food for doves in hunting preserves, was severely damaged by blight (*Cercospora sesami*) [*R.A.M.*, xvii, pp. 294, 296], which was found to be present to a maximum extent of 16 per cent. internally in seed samples from the same State, Georgia, and Florida. Virtually complete control of this source of contamination was effected by 30 minutes' immersion of the seed in water heated to 128° F., while surface-borne inoculum was eliminated by treatment for the same period at 118°. Over one year's storage freed heavily diseased seed from superficial infection but the fungus still persisted in the interior. The practical utility of the hot-water treatment was demonstrated on large-scale plantings in 1939 and 1940.

Bell (A. F.). **Cane disease control boards. School of instruction for inspectors.**—*Aust. Sug. J.*, xxxiii, 3, pp. 123, 125, 1941.

Fifteen representatives of seven of the eight cane disease control boards constituted under the 1938 amendment of the Sugar Experiment Stations Acts attended a school of instruction held at the Bundaberg (Queensland) Sugar Experiment Station from 12th to 16th May, 1941, at which lectures and laboratory demonstrations were given and the more important sugar-cane diseases individually studied with a view to familiarizing inspectors with their symptoms and so facilitating early recognition and prompt application of control measures. By this means it is hoped to arrest the spread of serious diseases to non-infected areas.

Edgerton (C. W.). **The mosaic disease and Co. 281.**—*Sug. Bull., N.O.*, xix, 10, pp. 28–29, 1941. [Abs. in *Sugar*, xxxvi, 8, p. 43, 1941.]

The Co. 281 sugar-cane variety, though very valuable from the standpoint of its adaptability to Louisiana conditions, sustains virtually 100 per cent. damage from mosaic [*R.A.M.*, xviii, p. 621], and it is questionable whether it can be cultivated on a profitable basis, though at the moment it seems impracticable to discard it in the absence of any promising substitute. This being the case, it is absolutely essential to secure disease-free seed stock by the systematic and thorough roguing of fields set aside for the purpose.

Martin (G. W.). **Outline of the fungi.**—*Univ. Ia Stud. nat. Hist.*, xviii (Suppl.), 64 pp., 8 pl., 1941.

This supplement is the writer's valued 'Key to the families of fungi' [*R.A.M.*, xix, p. 365] in its latest form with the addition of a short account of the lichens and eight plates giving details of representative named fungi.

Henrici (A. T.). **The yeasts: genetics, cytology, variation, classification and identification.**—*Bact. Rev.*, v, 2, pp. 97–179, 1941.

This is an exhaustive critical discussion of outstanding contributions (mostly of the past decade) to the knowledge of the genetics, cytology,

induced and spontaneous variations and mutations, classification, and identification of yeasts, including those concerned in the etiology of various human and animal diseases, and species of interest in connexion with the fermentation industries. A six-page bibliography is appended.

Teng (S. C.). **Supplement to higher fungi of China.**—*Sinensia*, xi, 1–2, pp. 105–130, 1940.

Included in this critically annotated list of species of fungi additional to those already cited in the author's 'Higher Fungi of China' are *Ascochyta phaseolorum* on bean (*Phaseolus vulgaris*) and cowpea leaves, *Septoria lactucae* on lettuce foliage, *Alternaria brassicae* (Berk.) Sacc. on cabbage, and *Oospora citri-aurantii* and *Alternaria citri* on tangerine orange (*Citrus nobilis* var. *deliciosa*) fruits, all in Szechwan. *Chrysomyxa tsugae* n.sp. is closely related to *C. abietis* [*R.A.M.*, xvii, p. 348], from which it differs chiefly in its rotund and less elongated orange sori, 0·6 to 1·2 mm. in diameter, 0·5 to 0·7 mm. in height, broader teleutospores (16 to 29 by 14 to 21 $\mu$), and its occurrence on *Tsuga yunnanensis* in the Hunba Forest, Sikang, mostly isolated, young, over-topped trees being attacked, sometimes with the loss of almost all the needles. The pycnidial, aecidial, and uredo stages of the rust are unknown. The oblong, ovoid, or subglobose, hyaline- and smooth-walled teleutospores occur in chains of 20 to 25 in columns 300 to 500 $\mu$ long.

Supplementary notes and particulars as to distribution are given in connexion with species previously reported.

Ou (S. H.). **Phycomycetes of China I. II.**—*Sinensia*, xi, 1–2, pp. 33–57; 5–6, pp. 427–449, 32 figs., 1940.

Included in this critically annotated list of Phycomycetes from Szechwan, China, is a new species of *Plasmopara*, *P. calaminthae*, found on the leaves of *Calamintha chinensis*. *Empusa muscae* was found on a species of Cordyluridae attached to a head of barley and *E. grylli* [*R.A.M.*, xviii, p. 140] on locusts.

Jenkins (Anna E.) & Cheo (C. C.). **Descriptions of Elsinoe dolichi, n.sp., and Sphaceloma ricini, n.sp.**—*J. Wash. Acad. Sci.*, xxxi, 9, pp. 415–417, 1941.

Pending the publication of a full description of *Elsinoe dolichi* Jenkins, Bitancourt & Cheo n.sp. on *Dolichos lablab* and *Sphaceloma ricini* Jenkins & Cheo n.sp. on *Ricinus communis*, both observed in Yunnan, China, Latin diagnoses are given of the two species. *E. dolichi* produces on the leaves of its host pale yellow lesions, sometimes furnished with chestnut-coloured, often raised margins, more or less following the course of the veins, up to 4 mm. in diameter; on the petioles and stems globose, becoming elliptical or elongated, flat or sunken cankers, up to 1 cm. by 3 mm., of a pale colour, sometimes provided with yellow or black to purple, often raised margins; and on the pods roughly orbicular, punctate cankers, up to 5 mm. in diameter, usually brown or purplish-brown with pale centres; the mostly pulvinate, often erumpent, amphigenous ascomata measure 60 to 300 by 100 $\mu$ and are occupied by one or more layers of subglobose

to piriform or ellipsoid asci, 20 to 32 by 15 to 22 $\mu$, containing hyaline, uni- to triseptate ascospores, 7 to 13 by 3 to 5·2 $\mu$; the conidiophores, 10 by 3·6 to 5·3 (at the base) $\mu$, bear on the host few, scattered, elliptical conidia, up to 3·5 $\mu$ in diameter, while in culture these organs may be globose, 2·5 to 3·5 $\mu$ in diameter, or ellipsoid, 3 to 4·6 by 1·5 to 1·8 $\mu$, and are hyaline. The fungus was also found on material of the same host from Kenya and Uganda.

The lesions formed by *S. ricini* on the leaf blades of castor beans are orbicular or suborbicular, of a papery texture, averaging 2 to 3 mm. in diameter, subcontinuous along the veins, verruciform; on the petioles and stems they are elliptical to elongated, often acuminate at both ends, reddish-brown at first, then yellow or white with a brown or black to purple margin; the conidiophores, which are subuliform or cylindrical, mostly simple, continuous or uniseptate, 10 to 30 by 3 to 5 $\mu$, occur in compact yellowish or amber-coloured palisade or separated or single, and bear apical and terminal, oblong, ovoid, or elliptical conidia, some only 1 to 2 $\mu$ in diameter, others up to 10 to 15 by 2·5 to 4·5 $\mu$, the small ones hyaline and the larger often yellowish and fusiform. Material of the fungus from the same host in Formosa, Japan, was also examined.

WAGER (V. A.). **Descriptions of the South African Pythiaceae with records of their occurrence.**—*Bothalia*, iv, 1, pp. 3–35, 18 figs., 1941.

After stating that the Pythiaceae are common and widely distributed in South Africa, where they have been isolated on over 100 occasions from 44 different hosts, the author gives full, annotated descriptions of the fungi of this group collected (mostly by himself) in the Transvaal and neighbouring localities. All are allocated to 10 known species of *Pythium*, viz., *P. ultimum* (locally the commonest of the Pythiaceae), *P. aphanidermatum*, *P. irregulare*, *P. vexans*, *P. myriotylum*, *P. splendens*, *P. spinosum*, *P. acanthicum*, *P. oligandrum*, *P. de Baryanum* (= *P. fabae*), and *P. de Baryanum* (= *P. de Baryanum* var. *pelargonii*), and 7 of *Phytophthora*, viz., *P. infestans*, *P. parasitica*, *P. citrophthora*, *P. cactorum* (= *P. citricola*), *P. cinnamomi*, *P. cryptogea*, and *P. syringae* (*P. hibernalis*). Two tables are given showing the temperature relations of these fungi, and the paper concludes with an annotated host index and a bibliography of 30 titles.

DOIDGE (ETHEL M.). **Some South African Valsaceae.**—*Bothalia*, iv, 1, pp. 47–90, 15 pl., 1941.

Descriptions are given of all fungi of the Valsaceae recorded from South Africa, including some species, apparently hitherto undescribed, collected by MacOwan and Medley Wood towards the end of the nineteenth century [cf. *R.A.M.*, xviii, p. 819]. No attempt could be made at a natural classification, and an artificial key to the genera is provided. The fungi dealt with include *Valsa leucostoma* [ibid., xvii, p. 46], *Diaporthe citri*, of which the conidial form, *Phomopsis citri*, is moderately common on citrus fruits and twigs in the Union and in Rhodesia [ibid., xvii, p. 311], and *D. perniciosa*, the *Phomopsis* stage of which [*P. mali*] has been observed on apple twigs in [Southern] Rhodesia [ibid., xvii, p. 755].

Doidge (Ethel M.). **South African Ascomycetes in the National Herbarium.**—*Bothalia*, iv, 1, pp. 193–217, 5 figs., 1941.

Descriptions are given of 36 South African Ascomycetes, including 13 species regarded as new.

Doidge (Ethel M.). **South African rust fungi. IV.**—*Bothalia*, iv, 1, pp. 229–236, 6 figs., 1941.

In continuation of her earlier work [*R.A.M.*, xix, p. 168] the author gives descriptive notes on 13 further species of South African rusts, including eight new species and one new name. The rusts listed include *Puccinia antirrhini* on *Antirrhinum majus* leaves and stems, first recorded in South Africa in 1939 [ibid., xix, p. 350], *P. kuhnii* on leaves of *Saccharum spontaneum*, *P. mcCleanii* n.sp. on leaves of *Gladiolus ludwigius*, and *Uromyces dolicholi* on leaves of pigeon pea.

Mendoza (J. M.) & Leus-Palo (Simeona). **New or noteworthy Philippine fungi, III.**—*Philipp. J. agric.*, lxxv, 2, pp. 165–183, 9 figs., 1941.

In this paper [cf. *R.A.M.*, xii, p. 115] the authors describe nine new species of *Cercospora* found in the Philippine Islands, including *C. carthami* n.sp. on the leaves of safflower (*Carthamus tinctorius*). In addition, 20 fungi are newly recorded, including *Cercospora chrysanthemi* on leaves of *Chrysanthemum* sp., *Cercospora cucurbitae* on leaves of squash (*Cucurbita pepo*), *Cercospora hydrangeana* on leaves of *Hydrangea ortensia*, *C. sorghi* on maize leaves, and *C. pachypus* on sunflower leaves.

Dearness (J.). **New species of Tennessee fungi.**—*Mycologia*, xxxiii, 4, pp. 360–366, 1941.

This is a list of 17 hitherto undescribed fungi (including a few new combinations and varieties and one fungus described on another host), collected in Tennessee since the destruction by fire of the University of Tennessee herbarium in 1934. The new species listed include *Phyllosticta hesleri* on *Acer saccharum*, *Phlyctaena tiliae* on *Tilia americana*, *Leptothyrium parvulum* and *Gloeosporium ferrugineum* on *Rhododendron punctatum*, *Leptostromella bignoniae* on *Bignonia capreolata*, *G. papulatum* on *Rubus canadensis*, and *Cercospora halesiae* on *Halesia carolina*. *Dothiorella mali* Karst. *fructus* var. nov. on decaying fruit of apple is stated to be very near *D. cydoniae*, which Saccardo considers to approximate to *D. mali*, the conidial measurements being 6 to 10 by 3 $\mu$ for *D. mali* and 10 to 12 by 3·5 $\mu$ for *D. cydoniae*. *Coryneum rhododendri* Schw. *fusoideum* var. nov., apparently parasitic on *Rhododendron catawbiense*, is stated to have features common to both *C. rhododendri* and *C. triseptatum*. *Cladosporium epiphyllum* is considered to be possibly the cause of circular dark leaf spots on *Robinia pseud-acacia*. *Briosia azaleae* (Peck) comb. nov. is given as a synonym of *Periconia azaleae* and *Sporocybe azaleae* [*R.A.M.*, xix, p. 599].

Subba Rao (M. K.). **Report of the Mycologist, 1940–41.**—*Adm. Rep. Tea sci. Dep. unit. Plant. Ass. S. India, 1940–41*, pp. 51–62, 2 graphs, 1941.

In this report [cf. *R.A.M.*, xviii, p. 821] it is stated that infection

of tea leaves by *Corticium invisum* [loc. cit.] has now become serious in the region of the Anamalai Hills, Madras.

A heavy outbreak of black root rot (*Rosellinia arcuata* and *R. bunodes*) [ibid., xviii, p. 579; xix, p. 369] occurred in the Nilgiri-Wynaad area. The presence of decaying organic matter is essential for the development of infection. The disease thrives in neutral and alkaline conditions, and tolerates moderately acid ones. Within a year of being buried in the soil incompletely decayed prunings had developed fructifications of *R. arcuata* and *R. bunodes.* It was ascertained that infection may begin near the collar (sometimes above it) and spread both upwards and downwards. As regards control, whether infection comes from the roots or the aerial parts, all sources of infection must be removed before disinfection is undertaken. If the attack begins in the aerial parts, the ground round the perimeter of the bush must be cleared. Weeds, mulch, and buried prunings must be removed, and the collar exposed sufficiently to reveal any fungal growth on the plant organs. The collected waste may be scorched with a blow-lamp and later removed for thorough burning, when the bushes have been disinfected. If careful inspection shows infection to be no more than superficial, the only treatment necessary may be to apply a fungicide to the affected area, with or without scraping off the superficial mycelium. If the fungus has invaded the tissues, all the affected part must be cut back to the healthy wood [cf. above, p. 42]. After the diseased tissues have been removed, the plant must be treated with a fungicide. Very encouraging results have followed even a single application of 1 per cent. Burgundy mixture, which not only controlled the disease, but also exercised a tonic effect, causing the formation of more buds on the treated surface. Any recurrent cases should receive attention from a gang going round at regular intervals. All treated bushes must be constantly inspected.

Treatment along these lines appears to have cost from 20 to 50 rupees per acre, and more than 100 acres have been dealt with. As the value of a tea bush is 8 annas, the procedure has been well worth while. Clear indications exist that, after nearly eight months, the disease has been checked, and the number of dead bushes reduced to negligible proportions.

The defoliation and gradual deterioration of *Grevillea robusta* trees in the High Range mountains, attributed hitherto to a *Phyllosticta* [ibid., xix, p. 678], have now been found to be associated also with a *Cercospora.* Direct evidence conclusively demonstrated that the leaf fall, die-back, branch canker, and gummosis were due to the effects of winds and adverse soil and climatic conditions. The fungi were of secondary importance.

*Albizzia moluccana* in the Wynaad district showed defoliation due to infection by a *Cercosporella,* favoured by misty, humid conditions.

JOHNSON (J.). **Chemical inactivation and the reactivation of a plant virus.**—*Phytopathology,* xxxi, 8, pp. 679–701, 1 fig., 1941.

For his studies at the Wisconsin Agricultural Experiment Station on the influence of 41 chemicals on the infectivity of the ordinary tobacco mosaic virus the writer made use of a special technique [which

is fully described], herein referred to as the agar disk method, permitting the diffusion of the test substances to the virus and their subsequent partial or complete extraction with water.

Among the common organic substances found to act as immediate inactivators were milk, blood serum, citrus fruit, *Phytolacca rigida*, and aphid extracts, trypsin [*R.A.M.*, xiv, p. 199], the growth products of *Aerobacter aerogenes* [ibid., xvii, p. 209] and *Aspergillus niger*, and charcoal. Milk (whole, skimmed, or whey) was almost as effective in dilutions of 1 : 10 as at full strength, and its inhibitory property was not appreciably impaired by pasteurization, sterilization, or boiling. Cucumber virus 1 and the potato veinbanding and tobacco etch viruses proved even more sensitive to the action of milk than tobacco mosaic, but potato ring spot was somewhat more resistant. These data suggest the utility of some such substance as milk for the separation of certain virus combinations [ibid., xviii, p. 266]. The results obtained in the present investigation with the *Aerobacter* inactivator are comparable to those secured by Stanley with 2 per cent. trypsin [ibid., xiv, p. 199], the former, however, being even more effective in the reduction of infection on application following inoculation, while treatment of the host before inoculation often inhibited the development of symptoms for as long as a week. At the same time there is no evidence that trypsin, blood serum, milk, and other substances of like efficiency as virus inactivators modify the host in such a way as to immunize it against infection, their effects being apparently achieved by the formation of a relatively loose specific molecular union (chemical adsorption or physical absorption), usually disintegrating on the removal of the inhibitor with water.

Among the 28 inactivating chemicals permitting partial or total reactivation of the virus following extraction with water were nitric, hydrochloric, acetic, citric, lactic, oxalic, picric, and tannic acids, ten inorganic salts (including ammonium and copper sulphates, lead acetate, and mercuric chloride), formalin, and alcohol. On the other hand, 0·1 per cent. bromine, 3 per cent. hydrogen peroxide, 1 per cent. iodine in potassium iodide, 1 per cent. *P. rigida* extract, 0·05 per cent. potassium permanganate, 0·05 per cent. safranin, 0·1 per cent. trisodium phosphate, and 0·5 per cent. potassium hydroxide consistently failed to allow of any appreciable degree of reactivation. Chemicals able to cause destruction or death of the virus may be grouped as toxic agents, oxidizing agents, and reagents with a $P_H$ of approximately 1·5 or lower and 11·0 or above.

It is suggested that the term inactivation (as opposed to destruction) be reserved to express temporary loss of infectivity.

Stanley (W. M.). **Chemical properties of viruses.**—*Sci. Mon., N.Y.*, liii, 3, pp. 197–210, 14 figs., 1941.

In this review the author states that in his studies with C. A. Knight, the proportions of certain aromatic amino acids were found to vary with the strain of the tobacco mosaic virus under investigation. For instance, the analysis of twelve preparations of tobacco mosaic virus gave 3·8, 4·5, and 6 per cent. of tyrosin, tryptophane, and phenylalanin, respectively, while the corresponding values in the case of the Holmes

rib grass [*Plantago lanceolata*] strain of the tobacco mosaic virus were 6·4, 3·5, and 4·3 per cent., and in that of the nearly related cucumber mosaic virus 4, 3·8, 1·4, and 10·2 per cent., respectively. These data are regarded as significant in connexion with the mutation of a virus, the formation of a new strain of which induces a fresh set of symptoms.

Some progress has been made in the development of methods for modifying the chemical structure of the tobacco mosaic virus without impairing its infective activity. Thus, Dr. Anson and the writer found that the sulfhydryl groups of the virus can be abolished by reaction with iodine without any sacrifice of its normal biological activity, though the structural change due to the iodine treatment was not perpetuated in succeeding generations. With Dr. Miller it was demonstrated that most of the amino groups of the tobacco mosaic virus may be acetylated by means of ketene without causing a measurable change in the specific virus activity or in the nature of the disease induced in tobacco. Similar results have been obtained with virus modified by the introduction of some 3,000 phenylureido groups per molecule of virus by means of reaction with phenylisocyanate. These data indicate that a large portion of the surface structure of the virus may be changed without interference with the basic reaction of virus reproductions. Immense importance is attached by the author to 'the purposeful production of new and useful strains (of viruses) by chemical means', not only from a practical standpoint, but also in relation to the wider and fundamental problem of the nature of virus activity.

SPENCER (E. L.). **Correlation of activity per unit weight of Tobacco-mosaic virus with age of lesion.**—*Science,* N.S., xciv, 2430, pp. 96–97, 1941.

In studies at the Rockefeller Institute for Medical Research the biological activity of ultracentrifuged tobacco mosaic virus per unit weight of virus protein was assayed on Early Golden Cluster bean [*Phaseolus vulgaris*] plants by the local lesion method, as modified by Spencer and Price (*Amer. J. Bot.*, xxviii, 1941).

The results obtained demonstrated that the content of virus protein in an inoculated tobacco leaf and also the activity per unit weight of the material continued to increase for twenty days after inoculation. The virus, apparently, was less active in young than in older lesions. It was also found that virus protein from the inoculated leaf was more active than that isolated at the same time from the top of the plant. Preliminary analyses with the ultracentrifuge showed that a preparation from the old lesions had only one component; a sample prepared at the same time from young lesions appeared to be made up of two components, of which one was approximately twice the length of the other, as determined by the sedimentation constant.

Experimental evidence also indicated that nitrogen may be an important factor in increasing the activity per unit weight of virus *in vivo*. When nitrogen was withheld from the tobacco plant 10 days after inoculation, virus protein in the inoculated leaf continued to form for about the usual period, but its activity, on a weight basis, remained fairly constant at the level reached about the time when nitrogen was last added. Activity at this point was about half that ultimately

displayed by virus protein from normal, nitrogen-fed plants. Preliminary tests indicated that it may perhaps be possible to increase this unit activity *in vitro* by supplying the virus with suitable forms of nitrogen.

It is evident from these observations that virus in new lesions displays on a unit weight basis only a fraction of its potential biological activity, and that it may differ in size and shape from virus isolated from older lesions.

Bouguy (S. M.). Об уходе за махорочными растениями, пораженными вирусом. [On the treatment of Indian Tobacco plants affected by virus.]—*C. R. Pan-Sov. V. I. Lenin Acad. agric. Sci., Moscow, 1941*, 5, pp. 11–15, 2 figs., 1941.

The losses caused by tobacco mosaic in the U.S.S.R. [*R.A.M.*, xx, p. 324] are stated to amount approximately to from 3 to 5 per cent. of the entire yield of ordinary tobacco [*Nicotiana tabacum*], while those of Indian tobacco [*N. rustica*] are only slightly less. During 1940, virus diseases, and particularly one resembling mosaic, were very prevalent on Indian tobacco in the Ukraine. In an attempt to control the disease, the tops of the plants with the deformed leaves were pinched out just above the healthy looking leaves on the assumption that (1) the older parts of the plants would be more resistant to infection, (2) the water balance of the plant would be thus improved, and (3) the side shoots growing from the lower part of the plant would encounter more favourable climatic conditions, developing as they did later in the season. The results of this treatment applied on several farms showed that plants thus treated developed healthy side shoots and weighed on the average 86 per cent. of the weight of a healthy plant, whereas diseased untreated plants weighed only 36 per cent. The nicotine content of treated plants was higher (9·05 per cent.) than that of the untreated, whether diseased (6·28 per cent.) or healthy (8·24 per cent.). Treated plants usually reached commercial maturity slightly later than healthy ones. The side shoots were stronger and their leaves larger and more healthy in appearance the lower the level at which the top was broken off.

Kausche (G. A.). **Über Transplantation und Kreuzungsversuche zur Frage der natürlichen und erworbenen Infektreaktion bei virus infizierten Tabakpflanzen.** [On transplantation and hybridization experiments in connexion with the question of the natural and acquired reaction to infection in virus-infected Tobacco plants.]—*Naturwissenschaften*, xxix, 27, pp. 404–405, 1941.

The grafting of *Nicotiana glutinosa* (reacting to the tobacco mosaic virus by the development of isolated lesions) on Samson tobacco (responding with systemic symptoms) resulted in the former giving both local and systemic symptoms on infection, indicating that the stock secretes a substance reversing the normal reaction. However, axillary buds removed from the scion and rooted reacted similarly to normal *N. glutinosa* plants. On the other hand, no such reversal in the response of *N. glutinosa* to the virus follows the grafting of Samson on *N. glutinosa*, infection being localized in the stock and the scion remaining free from infection. In grafts of *N. glauca* (symptomless) on

Samson and reciprocally, a reversal of the normal reactions occurs only if Samson is inoculated.

In crossing experiments in both directions with Samson and *N. glutinosa*, when *N. glutinosa* provided the pollen, the $F_1$ progeny took almost entirely after the former in growth habit, whereas the latter was physiologically dominant, the offspring reacting to the tobacco mosaic virus by local infections. In the reciprocal cross the response of the progeny is similar to that of Samson, i.e., the virus becomes systemic.

The following conclusions are provisionally drawn from these observations. In vegetative combinations of two variously reacting types one partner may exert an influence on the other, the most plausible explanation of which lies in the removal by the Samson stock of the 'barrier' permitting local infection only in *N. glutinosa.* The fact that such an influence is operative only during the continuation of the partnership also points to the fact that the nature of the reaction in a given host is conditioned by the substratum.

Burkholder (W. H.) & Li (C. C.). **Variations in Phytomonas vesicatoria.**—*Phytopathology,* xxxi, 8, pp. 753–755, 1941.

Inoculation experiments were carried out at Cornell University, New York, during the winter of 1939–40 with ten isolates (seven from pepper [chilli] and three from tomato) of *Phytomonas* [*Xanthomonas*] *vesicatoria* on different varieties of both hosts (mostly the foliage) with the following results. A Vermont chilli strain of the pathogen produced no infection on tomato, a very few small lesions were caused by three from the same host from Long Island, while three chilli isolates from Florida and three from tomato (Vermont, New York, and a culture from Mary K. Bryan) caused considerable infection. Two strains of *X. vesicatoria* from tomato were also pathogenic to tetraploid plants of the same host. The chilli isolates from Long Island produced abundant infection on the Bullnose, Chinese Giant, World Beater, California Wonder, and Ruby King chilli varieties, whereas the reaction of Oshkosh and Harris's Early Giant was very slight. The Vermont chilli strain and the three from tomato induced slow infection of all the chilli varieties. From these data the Vermont and Long Island chilli isolates are adjudged to be mutually related and distinct from the tomato strains, while the chilli isolates originating in Florida occupy an intermediate position. The only cultural difference between the various strains of possible utility as a physiologic criterion is the capacity to hydrolyse starch, which was confined to the tomato isolates, including two received from Indiana later than those mentioned above, one being identified as *P. vesicatoria* var. *raphani* (White) Burk. It is evident from these data that definite races of the parasite do exist, but the differences are insufficient for the establishment of varietal names. The number of races is unknown, but selection and breeding work will have to take into account their existence.

Lavallée (E.). **Quatre maladies des Tomates d'introduction récente dans la région de Montréal.** [Four Tomato diseases of recent introduction in the region of Montreal.]—*Ann. Ass. canad.-franç. Sci.*, vii, pp. 136–137, 1941.

Four tomato diseases recently introduced into Quebec are bacterial

spot (*Bacterium vesicatorium*) [*Xanthomonas vesicatoria*], causing an estimated loss of 50 per cent. at Saint-Césaire in 1938; bacterial canker (*Aplanobacter michiganense*); nailhead spot (*Macrosporium* [*Alternaria*] *tomato*) in two plantations at Île Bizard, where 80 to 90 per cent. of the fruits were unfit for sale; and buckeye rot (*Phytophthora terrestris*) [*P. parasitica*: *R.A.M.*, xx, p. 501], causing 5 per cent. damage at Berthierville.

WORLEY (C. L.), LESSELBAUM (H. R.), & MATTHEWS (T. M.). **Deficiency symptoms for the major elements in seedlings of three broad-leaved trees.**—*J. Tenn. Acad. Sci.*, xvi, 2, pp. 239–247, 1941.

Experiments are described in which *Catalpa speciosa*, *Ailanthus altissima*, and elm (*Ulmus pumila*) seedlings were grown in sand cultures from which calcium, potassium, magnesium, sulphur, potash, nitrogen, and iron were severally withheld. The characteristic deficiency symptoms which developed are described in detail for each element under the different species.

PIRONE (P. P.). **Maintenance of shade and ornamental trees.**—xvii+422 pp., 175 figs., New York, Oxford University Press, 1941. $4.50.

The first part of this well-illustrated, useful work deals with general practices in the maintenance of shade and ornamental trees. Part two (pp. 129–384) treats of specific abnormalities and comprises chapters dealing with the diagnosis of tree troubles, non-parasitic injuries, spraying equipment and methods, and disease control in general. These are followed by sections on the symptoms, causes, and control of the fungal, bacterial, insect, and virus diseases of all the important trees and shrubs grown in the eastern and mid-western parts of the United States. A selected bibliography is appended to each chapter.

WATERMAN (ALMA M.). **Diseases of shade and ornamental trees: annotated list of specimens received in 1940 at the New Haven office, Division of Plant Pathology.**—*Plant Dis. Reptr*, xxv, 7, pp. 181–186, 1941. [Mimeographed.]

This annotated list of fungi inducing diseases of shade and ornamental trees received at New Haven in 1940 includes *Macrophoma* sp., causing leaf blight of *Cupressus arizonica* in Alabama and Texas, and *Hendersonia magnoliae* producing leaf spot of *Magnolia grandiflora* in Virginia, the latter being, apparently, a new record for the United States. The evidence obtained in relation to the former disease shows that there is an injurious leaf blight of species of *Cupressus* in the southern States, with which a *Macrophoma*-like fungus is associated. Further investigation is required, however, before it can be determined whether this organism is identical with *M. cupressi* (Cke & Hark.) Berl. & Vogl., or whether it is a new, unnamed species.

TILFORD (P. E.). **Your shade trees. Tree wounds and their treatment.**—*Amer. Forests*, xlvi, 7, pp. 326–327, 2 figs., 1940.

In recent experiments to determine the most satisfactory type of wound dressing for common shade and forest trees, asphaltum prepara-

tions, which are free from injurious substances, consistently expedited healing, which was uniformly retarded, on the other hand, by Bordeaux paint.

POMERLEAU (R.). **Notes sur les maladies de l'Érable à Sucre.** [Notes on Sugar Maple diseases.]—*Ann. Ass. canad.-franç. Sci.*, vii, pp. 103–104, 1941.

Several new diseases of sugar maples [*Acer saccharinum*] have been studied in Quebec, including a trunk canker caused by *Eutypella parasitica* [*R.A.M.*, xix, p. 243], pure cultures of which were readily obtained and used in inoculation experiments.

GROVES (J. W.). **Pezicula carnea and Pezicula subcarnea.**—*Mycologia*, xxxiii, 5, pp. 510–522, 3 figs., 1941.

Detailed descriptions, and cultural and taxonomic notes are given on two species of *Pezicula* from Canada [*R.A.M.*, xviii, p. 761]: *P. carnea* on *Acer* spp., most commonly *A. rubrum*, and a new species, *P. subcarnea*, collected only on *A. pennsylvanicum*. Both species have a typical *Cryptosporiopsis* conidial stage.

WOLF (F. A.) & DAVIDSON (R. W.). **Life cycle of Piggotia fraxini, causing leaf disease of Ash.**—*Mycologia*, xxxiii, 5, pp. 526–539, 2 figs., 1941.

A study on the developmental cycle of the fungus *Piggotia fraxini* attacking various species of ash (particularly young trees in forest nurseries) throughout the United States [*R.A.M.*, xix, p. 328], showed the species to be polymorphic, with a conidial stage *Marssonia fraxini*, a spermogonial and carpogonial stage *Piggotia fraxini*, and a perithecial stage identified with *Mycosphaerella effigurata* (of which a list of synonyms and an amended description are given). The genetic connexion of these stages was demonstrated in cultural studies. All attempts at artificial infection in the laboratory and greenhouse were unsuccessful, but when old leaves bearing perithecia were attached to twigs of healthy trees in the forest, the conidial stage appeared on the young foliage after three weeks or more, and infection also resulted when leaves bearing conidia were attached to healthy twigs. In nature the fungus is commonly associated with other species such as *M. fraxinicola*, *Sphaerella fraxinea*, *Cylindrosporium fraxini* and *C. viridis*, and *Gloeosporium punctiforme*.

SMUCKER (S. J.). **Comparison of susceptibility of the American Elm and several exotic Elms to Ceratostomella ulmi.**—*Phytopathology*, xxxi, 8, pp. 758–759, 1941.

Inoculation tests in New Jersey in 1940 with spore suspensions of *Ceratostomella ulmi* through chisel wounds on several species of elms [*R.A.M.*, xviii, p. 558 *et passim*] resulted in 100 per cent. infection on *Ulmus americana*, *U. laevis*, *U. foliacea*, *U. procera*, *U. japonica*, and 'Mormon elm' (probably a small-leaved European variety), the corresponding figures for *U. pumila*, its vars. *pinnato-ramosa* and *arborea*, and *U. foliacea* var. Christine Buisman being 42, 70, 30, and 86 per cent., respectively. The mean percentages of die-back in the main

leaders ranged from 0 in the Christine Buisman variety to 90·9 in *U. americana*. Generally speaking, xylem discoloration was most pronounced and extensive in the more susceptible species.

LARGE (J. R.) & COLE (J. R.). **Control of nursery blight of Pecan seedlings by spraying with low-lime Bordeaux mixture.**—Abs. in *Phytopathology*, xxxi, 8, p. 768, 1941.

Under the excessively humid conditions prevailing in the south-eastern United States, budded pecan trees are liable to severe damage from nursery blight, caused by the *Sphaceloma* stage of *Elsinoe randii* [*R.A.M.*, xvii, p. 421], which invades leaflets of all ages, producing reddish lesions, averaging $\frac{1}{8}$ in. in diameter, on both surfaces, later turning ashen-grey on the upper sides and sometimes coalescing along the veins. Control of the disease was achieved in 1939 and 1940 by four applications of Bordeaux mixture, the first (at a strength of 4–1–100) being made between 5th and 15th April and the three following (6–2–100) at monthly intervals, the last about 10th July, the sprayed trees yielding nearly four times as many successfully budded trees as the unsprayed.

OU (S. H.). **A study of the Cercospora leaf-spot of Tung Oil tree.**—*Sinensia*, xi, 3–4, pp. 175–188, 9 figs., 1940. [Chinese summary.]

The agent of the leaf spot of tung oil trees, originally observed on *Aleurites cordata* in Hunan and described as *Cercospora aleuritidis* Miyake (*Bot. Mag., Tokyo*, xxvi, p. 66, 1912), has been found to be prevalent throughout Szechwan on the widely cultivated *A. fordii*, and is herein referred to *Mycosphaerella aleuritidis* (Miyake) Ou n.comb. [*M. aleuritidis* Ou n.sp.], another synonym being *Cercosporina aleuritidis* Sacc., Syll. Fung., xxv, p. 902, 1931.

The imperfect stage of the fungus, characterized by five to pluri-fasciculate, usually simple, somewhat denticulate, pale olivaceous, 1- to 5-septate conidiophores, 22 to 65 by 4·5 to 5 $\mu$, and acicular-obclavate, straight or slightly curved, hyaline, ultimately olivaceous, 2- to 12-septate conidia, 35 to 135 (mostly 50 to 80) by 3 to 4·5 $\mu$, is produced on the subcircular to irregular, rarely coalescent lesions, reddish- to dark brown on the upper and yellowish-brown on the under side, 4 to 16 mm. across, and the perithecia and spermogonia on the fallen diseased foliage, maturing in the spring. The gregarious, mostly hypophyllous, innate, globose, black, papillate perithecia measure 60 to 100 $\mu$ in diameter; the fasciculate, cylindrical to clavate, aparaphysate asci, 35 to 45 by 6 to 7 $\mu$, contain eight hyaline, ellipsoid, biseriate, bicellular ascospores, 9 to 15 by 2·5 to 3·2 $\mu$. The subglobose to ovoid spermogonia measure 50 to 70 by 45 to 60 $\mu$, and the hyaline, rod-shaped spermatia 3·5 to 4·5 by 0·5 $\mu$.

In pure culture different media and temperatures within a range of 12° to 30° C. exerted little influence on the growth of *M. aleuritidis*. Conidia developed from ascospores on sterilized *A. fordii* leaves only. The leaf spot was successfully induced on *A. fordii* by means of inoculation with conidial or ascospore suspensions.

The severity of the disease may be mitigated by the destruction of

fallen infected leaves during the winter, thereby eliminating the source of inoculum for the coming season.

Benton (V. L.) & Ehrlich (J.). **Variation in culture of several isolates of Armillaria mellea from Western White Pine.**—*Phytopathology*, xxxi, 9, pp. 803–811, 1 fig., 1 diag., 3 graphs, 1941.

At the Moscow School of Forestry, Idaho, the authors studied a number of western white pine (*Pinus monticola*) isolates of *Armillaria mellea* from the Cœur d'Alene National Forest [*R.A.M.*, xix, p. 126] with a view to determining the extent of physiological variation in malt agar cultures. The results of five experiments demonstrated wide variations between the several strains in cultural appearance, rhizomorph production, diameter of mycelial growth, degree of saprogenicity, and response to differences in wood moisture content, temperature, and hydrogen-ion concentration. The following optimal values were established: about 150 per cent. or slightly higher initial wood moisture content (initial oven-dry basis), 21° to 25° C. for growth on malt agar at $P_H$ 5, and $P_H$ 4·5 and 5·5 for development on the same medium at 25°. In one experiment involving 27 isolates, some were characterized by a cottony, white, profuse mycelium with a considerable number of long rhizomorphs; others produced a very sparse mycelium without rhizomorphs, while another series formed a reddish-brown sclerotial mat from the lower side of which a fair number of short rhizomorphs projected into the agar, longer ones also ramifying through the medium. The extent of mycelial growth made by the different strains over a 30-day period ranged from 38·5 to 54 mm.

Lohwag (K.). **Untersuchungen über die Holzzerstörung durch Fomes hartigii (Allesch.) Sacc. et Trav. und Fomes robustus Karst.** [Studies on wood destruction by *Fomes hartigii* (Allesch.) Sacc. & Trav. and *Fomes robustus* Karst.]—*Z. PflKrankh.*, l, pp. 481–494, 1940. [Abs. in *Zbl. Bakt.*, Abt. 2, ciii, 21–24, p. 407, 1941.]

*Fomes hartigii*, one of the commonest parasites of the silver fir [*Abies alba* (in Austria): *R.A.M.*, xvii, p. 358], invades the wood through the medullary rays, whence it passes into the tracheids, the upper and lower parts of which are both rapidly permeated by the hyphae. The penetration of the cell walls is accompanied by dissolution of the lignin, demonstrable by the phloroglucin-hydrochloric acid reaction. Besides lignin the fungus disintegrates cellulose and pectins, utilizing its enzymes for this purpose so that direct contact between the hyphae and the cell walls is not necessary. The so-called 'lines of demarcation', consisting of brown hyphal agglomerations, are visible in the infected wood.

The initial development of *F. robustus* [loc. cit.] in oak wood takes place in the vessels, in which, in fact, most of the hyphae are found even at an advanced stage of infection. The walls of the vessels withstand the attack of the pathogen, to which, however, the surrounding parenchyma cells and wood fibres succumb completely.

Sidki (I.). **Notes on the death of Stone Pine at Salamis.**—*J. Cyprus For. Ass.*, ii, 4, pp. 25–28, 1940.

Analyses of soil samples in the Salamis district of Cyprus, where

stone pines (*Pinus pinea*) suddenly began to die back in 1937, revealed a progressive increase in calcium carbonate in the deeper layers (e.g., from 39·3 per cent. at 6 in. to 62·5 per cent. at 3 ft.), leading to the formation of a calcareous hard pan through which the tap roots are unable to penetrate, other contributory factors to the pathological condition of the trees being lack of moisture and insufficient nutrition.

Gosselin (R.). **Notes sur le Polyporus circinatus Fr.** [Notes on *Polyporus circinatus* Fr.]—*Ann. Ass. canad.-franç. Sci.*, vii, p. 104, 1941.

*Polyporus circinatus*, the agent of a white pocket rot of the base of conifers, is widespread in Quebec on spruces [*R.A.M.*, xix, p. 445], especially *Picea rubens*, entering its host through the tap roots. Special environmental conditions, the exact nature of which has not yet been determined, are necessary for the development of the fungus.

Pomerleau (R.) & Morais (L.). **Les caries de l'Épinette noire à Duchesnay.** [Black Spruce rots at Duchesnay.]—*Ann. Ass. canad.-franç. Sci.*, vii, p. 103, 1941.

Of 277 black spruce [*Picea nigra*] trees examined at Duchesnay (Quebec) in 1939, 46 were infected by one or more forms of decay, of which *Fomes pini* was responsible for 69·5 per cent. involving 86·2 per cent. of the total volume, the corresponding figures for *Stereum sanguinolentum* and *Poria subacida* being 17·3 (5) and 13 (2·8) per cent., respectively, while other [unspecified] defects covered 4·6 per cent. of the volume. *F. pinicola* and *Armillaria mellea* caused secondary rots of wounded and dead areas.

Buchanan (T. S.) & Englerth (G. H.). **Decay and other volume losses in wind-thrown timber on the Olympic Peninsula, Wash.**—*Tech. Bull. U.S. Dep. Agric.* 733, 30 pp., 10 graphs, 1940.

General observational data were made annually from 1921 to 1924 and intensive detailed examinations were carried out in 1926, 1929, and 1936 on the condition of Douglas fir (*Pseudotsuga taxifolia*), Sitka spruce (*Picea sitchensis*), western hemlock (*Tsuga heterophylla*), silver fir (*Abies amabilis*), and western red cedar (*Thuja plicata*) blown down in January, 1921, on the Olympic Peninsula, Washington. The sources of loss were four, viz., breakage, high stumps, insect damage, and decay [unspecified]. No loss from decay was noted for at least two years after the storm, but once decay had become evident, loss from it soon exceeded that from any other source in all species except western red cedar.

The first zone invaded was the sapwood, with the adjacent heartwood. Western hemlock and silver fir, the two species with the highest percentage of sapwood and the least durable heartwood, decayed most rapidly. Sitka spruce showed much faster decay than Douglas fir or cedar. The sapwood of Douglas fir decayed somewhat rapidly, but the heartwood gave evidence of marked durability. Western red cedar suffered least.

The evidence indicates that if wind-thrown trees in the spruce-hemlock and Douglas fir old-growth types of the Washington and

Oregon coast are to be salvaged free from decay, requisite steps must be taken within one or two years of their being blown down. Douglas fir trees contain considerable saleable volume even 15 years after they have been blown down, but most of this sound volume occurs in trees over 30 in. in diameter. In Sitka spruce practically all sound wood, irrespective of tree size, is destroyed within 15 years. Western hemlock and silver fir, irrespective of size, are rendered worthless within eight years of being blown down. Even when the trees have been lying on the ground for 15 years, the loss from decay in western red cedar does not exceed the original sapwood volume.

Rennerfelt (E.). **Das Wachstum einiger Pilze aus Holzschliff bei verschiedener Temperatur.** [The growth of some fungi from mechanical wood pulp at varying temperatures.]—*Arch. Mikrobiol.*, xii, 1, pp. 19–40, 4 graphs, 1941.

A tabulated survey is given of the writer's experiments at the Gothenburg (Sweden) Botanical Institute on the growth at different temperatures between 5° and 42° C. of 14 fungi isolated from freshly ground wood pulp [*R.A.M.*, xix, p. 633] on a synthetic medium with the addition of saccharose and yeast extract.

The Torulopsidaceae, comprising *Rhodotorula glutinis*, *R. gracilis* [ibid., xvi, p. 575], *Torulopsis candida* [ibid., xviii, p. 198], and *T. mollischiana* (Zikes) Lodder, grew best at 22°, 27°, 22°, and 22°, respectively, the blue-staining fungi, *Phialophora fastigiata*, *Phoma lignicola* [ibid., xvi, p. 574], *Pullularia pullulans*, and *Trichosporium heteromorphum* [ibid., xvi, p. 575] at 22°, 22°, 27°, and 32°, respectively, the moulds *Aspergillus fumigatus* and *Penicillium rugulosum* at 37° and 32°, respectively, the Hyphomycete *Geotrichum candidum* at 22°, and the wood-rotting organisms, *Pholiota mutabilis* [ibid., xv, p. 72], *Polyporus* [*Polystictus*] *hirsutus*, and *P. versicolor* at 22°, 32°, and 27°, respectively. At 5° few of the fungi made measurable growth, *G. candidum* being the most active at this temperature; at 12°, however, there was appreciable development in the majority of the cultures, though *A. fumigatus* and *P. hirsutus* remained practically stationary. The maximum for the blueing fungi lay between 32° and 37°, except in the case of *T. heteromorphum*, which developed between 37° and 42°. The maximum for the moulds, *Torulopsis molischiana*, and *P. hirsutus* was not attained at 42°, whereas *P. versicolor* and *Pholiota mutabilis* succumbed at 37° and 27°, respectively. *R. glutinis* ceased to develop at 32° and *R. gracilis* between 37° and 42°. In the Torulopsidaceae the largest number of cells coincided with the optimum temperature for mycelial development, while the blueing fungi produced conidia in the greatest abundance at a temperature below the optimum for vegetative growth. At low temperatures cell division was generally slow but the cells persisted for lengthy periods in a viable condition, whereas at a higher range the reverse position tended to obtain, though with considerable differences among the individual organisms.

Discussing the bearing of these experimental data on the practical working of paper mills, the writer points out that the temperature of the backwater is a decisive factor in the development of micro-organisms in the fibre suspension, the maximum of 1,000 to 2,000 spores

per c.c. being reached in his experiments at 30° to 35° [ibid., xvi, p. 574].

ÖRNHJELM (R.). **Framställning av inhemskt blånadsskyddsmedel.** [Production of a home-produced preservative against blueing.]—*Papp. Trävarutidskr. Finl.*, xxii, 23, pp. 459–464, 10 figs., 2 graphs, 1940.

A Finnish pentachlorophenol preservative against the blueing of timber associated with species of *Mucor*, *Lenzites*, and *Hormonema* [*R.A.M.*, xiv, p. 270; xix, p. 57], sold under the trade name of Ky 5, is claimed to be equally effective with the American preparations, dowicide and santobrite, without their drawback of inducing dermatitis. The dosis toxica of Ky 5 for the three above-mentioned organisms, in the order named, in malt agar cultures was below 0·0025, 0·055, and below 0·0025 per cent., respectively, exactly the same values being obtained with dowicide. Like the imported preparations, Ky 5 is a strong poison and must be applied with the customary precautions.

EDGECOMBE (A. E.). **The growth rate of several wood-inhabiting fungi.** —*Phytopathology*, xxxi, 9, pp. 825–831, 1 fig., 1941.

At the Northwestern University, Evanston, Illinois, cultures of six lignicolous fungi, viz., *Collybia velutipes*, *Pleurotus ostreatus*, *Merulius lacrymans*, *P. ulmarius*, *Pholiota adiposa*, and *Armillaria mellea*, were grown in shaded light on 1 per cent. nutrient agar enriched with prune juice (from ½ lb. steamed fruit per l. agar) and adjusted to a hydrogen-ion concentration of $P_H$ 6, the temperature of the incubator being maintained at 25° C. Two series of tests were run, the first extending from 31st March to 2nd May and the second from 19th April to 21st May. Notwithstanding the uniformity of these highly favourable conditions, the fungi developed at different rates, their average daily growth in diameter of the colony in the order given above being 0·76, 0·77, 0·54, 0·46, 0·30, and 0·12 cm., respectively, in the first series of experiments, and 0·83, 0·82, 0·56, 0·51, 0·32, and 0·13 cm., respectively, in the second. The average daily growth increment for both *C. velutipes* and *Pleurotus ostreatus*, computed from these data, is 8 mm., the corresponding figures for *M. lacrymans*, *P. ulmarius*, *Pholiota adiposa*, and *A. mellea* being 5·5, 4·8, 3, and 1·2 mm., respectively.

OGILVIE (L.). **Diseases of vegetables.**—*Bull. Minist. Agric., Lond.*, 123, iv+84 pp., 12 figs., 1941. 1*s*. 6*d*.

This bulletin, stated in the foreword to be essentially a revision and expansion of No. 68 in the same series (second edition, 1935), has been rewritten mainly for growers, with emphasis on the description of symptoms, the influence of cultural practices on the incidence of disease in vegetable crops in England and Wales, and control measures.

WALKER (J. C.). **Disease resistance in the vegetable crops.**—*Bot. Rev.*, vii, 9, pp. 458–506, 1941.

The author succinctly reviews the history of investigations made since the middle of the last century into the nature of plant resistance

to fungal diseases, with special reference to the breeding of resistant varieties, and then deals in turn with such points as the nature of resistance, escape, exclusion of the pathogen by the host, resistance resulting from host-parasite interaction, variability of the pathogen, and the relation of environment to resistance, after which he discusses in detail resistance by specific vegetable crops to some of the chief fungal diseases affecting them. The paper concludes with a bibliography of 255 titles.

LACHANCE (R. O.). **Effets du calcium sur l'anatomie des feuilles de Choux de Siam malades par carence de bore.** [The effects of calcium on the anatomy of Siamese Cabbage [Turnip] leaves suffering from boron deficiency.]—*Ann. Ass. canad.-franç. Sci.*, vii, pp. 107–108, 1941.

The cambium and phloem of turnip leaves deprived of boron are replaced by an undifferentiated parenchyma. The addition of boron to the nutrient solution stimulates the differentiation of the parenchyma into wood vessels, and the same effect follows the immersion of boron-deficient leaves in boron or calcium chloride solutions, the latter inducing more rapid and extensive differential activity than the former. A close relationship between calcium and boron in plant metabolism is hereby indicated.

COONS (G. H.), KOTILA (J. E.), & BOCHSTAHLER (H. W.). **Black root investigations in Michigan and Ohio.**—*Proc. Amer. Soc. Sug. Beet Technol., East. U.S. & Can., 1941.* [Abs. in *Sugar,* xxxvi, 9, pp. 41–42, 1941.]

Drainage is well known to be beneficial in the reduction of sugar beet damping-off or black root (*Pythium* spp., *Rhizoctonia* spp., and *Aphanomyces* spp.), and good results have been obtained by arranging the plants on ridges with furrows at either side of two rows, or by the provision of furrows for each eight rows. Recent studies have shown *A.* spp. to be of great importance, not only as an agent of damping-off, but also as a cause of persistent rotting of the basal portion of the tap-root. Very promising results in the control of these organisms have been secured by the incorporation with the seed of liberal amounts of a phosphate fertilizer—three or four times the customary dose of 100 or 150 lb. per acre.

SMITH (P. G.) & WALKER (J. C.). **Certain environal and nutritional factors affecting Aphanomyces root rot of garden Pea.**—*J. agric. Res.*, lxiii, 1, pp. 1–20, 2 figs., 4 graphs, 1941.

In a study in Wisconsin of the root rot of garden pea caused by *Aphanomyces euteiches* [*R.A.M.*, xx, pp. 211, 245], the most rapid radial expansion of the fungus on potato dextrose agar was found to occur at 28° C., no growth being made either at 8° or 36°. In plants grown in sand the optimum temperatures for disease development were 24° and 28°; at 12° no infection was observed during a period of 11 days, whereas at the optimum temperatures nearly all plants were severely affected during that period. The optimum radial expansion of the fungus on phosphate-buffered potato dextrose agar occurred between

$P_H$ 4·5 and 6·5, the limits for growth being about $P_H$ 3·4 and slightly above $P_H$ 8·0. An apparent isoelectric point appeared at $P_H$ 5·9. In naturally infested soil practically no infection occurred when the moisture was maintained at 45 per cent. of the water-holding capacity, while at 75 per cent. infection was quite severe. In artificially infected sand cultures kept under conditions of controlled nutrition the severity of disease decreased in direct proportion to the increase in total salt concentration of the nutrient solution, being nil at the highest concentrations used and most severe at the lowest. Using dilute or concentrated solutions, having nitrogen, phosphorus, and potassium either in excess of the balanced solution or lacking each of them, had no effect on disease development. Under favourable conditions for infection in sand cultures all plants may become infected within five days. After infection had occurred, high nutrient concentrations did not appear to inhibit the development of the disease. On agar made from nutrient solutions used in the sand culture the fungus grew readily on the high concentrations that had been found to inhibit its growth in sand cultures. It is suggested that the absence of infection in the presence of high salt concentrations in sand cultures is due to some other cause than the salt concentration. It is thought possible that pea plants acquire a morphological resistance as a direct result of the high concentration of the nutrient.

McWhorter (F. P.). **Isometric crystals produced by Pisum virus 2 and Phaseolus virus 2.**—*Phytopathology*, xxxi, 8, pp. 760–761, 1 fig., 1941.

Using the trypan blue technique for virus identification (*Phytopathology*, xxx, p. 788, 1940), the writer demonstrated the presence in the cytoplasm and nuclei of horse bean (*Vicia faba*) cells infected by *Pisum* virus 2 and *Phaseolus* virus 2 [*R.A.M.*, xvi, p. 723], of isometric, deeply staining crystals, 0·3 to 4 $\mu$ in diameter. The nucleoli of diseased cells assume more or less cubical shapes in response to the development within them of one to five or more crystals. The occurrence of inclusion bodies within the nuclei, common in virus-infected animal cells, has been established only in one other instance in plants, viz., tobacco attacked by *Nicotiana* virus 7 [severe etch: ibid., xx, p. 602], and a basic relationship between the last-named and the legume viruses under discussion (long known to be closely allied in physiological properties and host range) is suggested by the isometric character of the crystalline inclusions in all three cases. The bean inclusions, though comparable in some degree to the hexagonal crystals of tobacco mosaic, are much more stable, being capable of being dissected out and persisting in paraffin sections fixed in aceto-formalin and in whole mounts processed by the dioxan technique (*Stain Tech.*, xi, pp. 107–117, 1936). They were found in every case investigated in which foliar mottling had been induced by the systemic invasion of either of the viruses, as well as in certain artificially inoculated legumes, but were absent from healthy leaves, so that their production is apparently a function of the virus rather than of the host. The crystals frequently occupied the stomatal guard cells.

**Bean diseases common in Wyong district.**—*Banana Bull., Sydney*, i, 60, p. 9, 1941.

According to Dr. Parbery, Soil Chemist, the widespread failure of dwarf French bean [*Phaseolus vulgaris* var. *nana*] crops raised from home-grown seed on the farms of the Wyong district of New South Wales is attributable to an excessive uptake of manganese (over 600 p.p.m.) from the dark grey, fine sandy, very acid loam soils. Symptoms of the disease, known locally as 'scald', include browning of the leaves, stunting, defoliation, and failure to set pods. Comparable seed samples grown by Dr. Parbery on a yellow sandy loam enriched with organic matter, dolomite, and complete fertilizers produced vigorous plants containing only 30 to 50 p.p.m. manganese. The examination of scalded crops in May, 1940, further revealed symptoms of magnesium deficiency in the form of a whitish-yellow discoloration of the leaves; the manganese content of such plants was inordinately high, reaching in extreme cases nearly 1,800 p.p.m., while phosphate and nitrogen were also present in excess.

The abnormally high uptake of manganese, iron, and possibly aluminium by 'scalded' bean plants, as well as the chlorosis associated with magnesium deficiency, are interpreted as different expressions of mineral depletions of soils, giving rise to excessive acidity, which it is believed may be remedied by the application of dolomite at a minimum rate of two tons per acre, the first dose being allowed to react with the soil for two months prior to planting.

Ware (W. M.) & Glasscock (H. H.). **Chocolate spot of Beans in 1941.**—*J. Minist. Agric.*, xlviii, 2, pp. 91–94, 1941.

In 1941 extensive damage to field beans by chocolate spot (*Botrytis cinerea*) [*R.A.M.*, xx, pp. 441, 442] was reported throughout the south of England. The authors obtained the opinions of a number of farmers on the conditions existing in about 100 infected fields. The evidence showed that intensity of attack ranged from slight spotting on a few leaves to the killing of all leaves and blossoms and stem-blackening. In about one-fifth of the cases the crop was beyond saving, and was ploughed in or cut for silage or hay; but at the time the decision was made only the lower leaves and blossoms of some of the plants were dead. Most of the undisturbed crops recovered when sunny weather returned, and yielded about one-half to two-thirds of the original estimate.

In some instances the first outbreaks occurred in early March; but the main attack began when, after a long period of drought, drizzle, mist, or light rain were of daily occurrence from 23rd May until 13th June. Early infections produced severe injury, but even when symptoms did not appear until June, much damage was sometimes caused.

There was no indication that the previous kind of crop planted influenced severity. Beans sown in September and October showed all degrees of attack, but of nine crops sown in November or December only one was severely affected. No infection was observed on spring-sown beans. Rate of seeding appeared to have no effect, and frost damage is not regarded as a main factor. There was some indication that potash or phosphate deficiency and bad drainage favoured attack,

but many growers commented on the excellent health of the plants before they were attacked. There is no doubt, however, that the outbreaks were favoured by wet weather early in the growing season.

YARWOOD (E. C.). **Sporulation injury associated with downy mildew infections.**—*Phytopathology*, xxxi, 8, pp. 741–748, 1941.

A tabulated account is given of the writer's quantitative studies at the University of California, Berkeley, on the injury inflicted on onion, hop, and spinach leaves by the sporulation of the downy mildews, *Peronospora destructor* [*P. schleideniana*], *Pseudoperonospora humuli*, and *Peronospora effusa*, respectively [*R.A.M.*, xix, p. 161].

The green weight reduction due to this source was shown by comparative measurements under controlled conditions to average 55 per cent. of the green weight of healthy leaves in three tests with onion, 17 per cent. in two with hops, and 48 per cent. in one trial with spinach. In field plots of infected Yellow Bermuda onions yield increases from the use of 2 per cent. rosin-lime-sulphur and 0·2 per cent. malachite green+SS3 (0·2 per cent. Grasselli spreader), both tending to inhibit the sporulation of *P. schleideniana*, exceeded those obtained with 0·25 per cent. cuprocide+0·25 per cent. CSO (0·25 per cent. cotton-seed oil emulsified with egg), which exercises less effect on the reproduction of the pathogen. The following were the clean seed yields (in gm.) per plot secured with the different treatments: controls 2·67, rosin-lime-sulphur weekly and fortnightly 46·2 and 4·32, respectively, and malachite green weekly and fortnightly 38·9 and 9·29, respectively.

Attempts to determine whether sporulation exerted any influence on water loss in infected onion and hop leaves gave inconclusive results. The respiration of non-sporulating mildewed leaves was 56 per cent. higher than that of healthy foliage, and the respiration of sporulating leaves 10 per cent. less than that of non-sporulating mildewed material.

On heavily sporulating onion leaves some 10 per cent. of the stomata were occupied by sporangiophores, the surface area of which plus sporangia approximately equalled that of the foliar surface. The dry matter content of the sporangiophores plus sporangia produced during the night of sporulation amounted to 5 per cent. of the dry weight of infected leaves, and this transfer of nutrients from the host to its parasite is believed to be the feature of sporulation most likely to be responsible for the injury observed.

LACHANCE (R. O.), BERTRAND (P.), & PERRAULT (C.). **L'atrophie du cœur du Céleri : maladie par carence de bore.** [Heart atrophy of Celery, a disease caused by boron deficiency.]—*Ann. Ass. canad.-franç. Sci.*, vii, p. 133, 1941.

Celery plants in Quebec suffering from 'heart atrophy' a hitherto undescribed physiological disease, are characterized by stunting (height 4 to 7 in.) and rigidity and brittleness of the petioles, those of the heart leaves being furthermore bent over and interlaced, turning brown and gradually shrivelling; ultimately they disappear completely, leaving a gap surrounded by the outer petioles. The condition is quite distinct from black heart, being found only on dwarfed plants and

invariably accompanied by cracking of the petiole. Effective control was given by the application of borax at the rate of 15 lb. per acre [cf. *R.A.M.*, xviii, p. 817].

PRICE (W. C.). **Classification of Hawaiian Commelina-mosaic virus.**—*Phytopathology*, xxxi, 8, pp. 756–758, 1 fig., 1941.

In greenhouse tests at the Rockefeller Institute for Medical Research, Princeton, New Jersey, a yellow strain of the mosaic virus affecting *Commelina nudiflora* in Hawaii [*R.A.M.*, xvi, p. 763] was readily transmitted to dicotyledonous hosts by means of rubbing, but more difficulty was experienced with a green strain, which in a second trial, however, infected Turkish tobacco. The virus was fairly easily conveyed from tobacco to other plants, and both strains infected *Nicotiana glutinosa*, *N. alata*, *N. bigelowii* var. *quadrivalvis*, *N. glauca*, cucumber, and *Zinnia elegans*, the symptoms being generally similar to, but distinguishable from, those of ordinary cucumber mosaic in the same host, while differences were also apparent between the effects of the *Commelina* mosaic strains and those of the southern celery mosaic strain of cucumber mosaic [ibid., xv, p. 195]. The yellow strain of the *Commelina* mosaic virus consistently induced a more brilliant coloration of the infected leaves than the green one. In cross-protection tests in 1940 on the Golden Gem variety of *Z. elegans* on the lines of those already described [ibid., xiv, p. 812], the yellow strain caused a green mottling, while the green one induced only mild, transient symptoms. In healthy plants inoculation with the cucumber mosaic virus induced profuse infection, whereas those protected by previous inoculation with the *Commelina* virus failed to develop a single lesion. These results, together with others not reported here, are considered to establish a close relationship between the *Commelina* mosaic virus strains and other representatives of the cucumber mosaic virus group, and indicate that *Commelina* in Hawaii is affected by a number of different strains of cucumber mosaic virus.

JENKINS (W. A.). **Some leaf spots and berry rots of Muscadine Grapes in Georgia.**—Abs. in *Phytopathology*, xxxi, 8, pp. 767–768, 1941.

In addition to diseases already reported from another source [*R.A.M.*, xx, p. 623], muscadine grapes in Georgia suffer from a foliar disorder caused by *Cercospora brachypus* and characterized by expanding, angular, chlorotic areas, which become necrotic in the centre and are surrounded by a narrow halo. The organism has a *Mycosphaerella* stage to be described elsewhere as a new species.

**Statutory rules and orders, 1941, No. 1726. Destructive Insect and Pest Acts, England. The Sale of Diseased Plants (Amendment) Order of 1941. Dated October 30, 1941.**

The present further Amendment, effective as from 15th November, 1941, to the Sale of Diseased Plants Order of 1927 [*R.A.M.*, xv, p. 464] provides for the insertion in Part B of the First Schedule to the principal Order a clause prohibiting the sale, or exposure for sale, for planting of any (crucifer) plants substantially attacked by *Plasmodiophora brassicae*.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
OF
# APPLIED MYCOLOGY

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WIEMER (H.). **Beiträge zur Rhizoctonia- und Zopfia-Krankheit an Spargel.** [Contributions to the *Rhizoctonia* and *Zopfia* disease of Asparagus.]—*Z. PflKrankh.*, l, pp. 459–472, 1940. [Abs. in *Zbl. Bakt.*, Abt. 2, ciii, 21–24, pp. 412–413, 1941.]

According to information gathered by the writer on a visit to the Rhenish-Hessian asparagus-growing districts in 1935, *Rhizoctonia crocorum* [*Helicobasidium purpureum*] is widespread and its range is increasing every year. Attacks on the roots led to the total destruction of the crop. The same pathogen infects fodder beets and carrots. It is most prevalent on heavy soils.

*Zopfia rhizophila* [*R.A.M.*, ix, p. 621], observed on the same occasion for the first time since its discovery in 1887, was responsible for random gaps in the stand involving losses of up to 80 per cent. of the crop. Numerous black perithecia, averaging 1 mm. in diameter and containing ascospores measuring 61 to 75 by 34 to 42 $\mu$, developed on the dead roots.

**Annual Report of the (Gambia) Department of Agriculture, for the year ending 31st May, 1941.**—8 pp., 1941.

On p. 3 of this report it is stated that rosette disease of groundnuts [*R.A.M.*, xx, p. 144] was again practically absent from the Gambia, the few isolated cases reported all occurring on late-planted farms.

SHAW (L.) & HEBERT (T. T.). **Copper-sulphate dusts and copper sprays give good control of Peanut leaf-spot diseases.**—Abs. in *Phytopathology*, xxxi, 8, p. 770, 1941.

Practical control of groundnut leaf spots [*Cercospora personata* and *C. arachidicola*] was consistently secured in three years' experiments [in North Carolina: *R.A.M.*, xix, p. 62] by four applications, at fortnightly intervals beginning between 1st and 10th July, of copper-sulphur dusts (5 to 20 parts of copper to 95 to 80 of sulphur) or copper-containing sprays, such as Bordeaux mixture and cuprous oxide. Treatments along these lines are stated to have produced increased yields of nuts and hay averaging 500 and 800 lb. per acre, respectively, and together worth \$15 per acre, at an inclusive cost of \$5 per acre.

**Plant pathology.**—*Adm. Rep. Dir. Agric. Ceylon, 1940*, pp. D5–D6, 1941.

During the period under review [cf. *R.A.M.*, xx, p. 290], single-plant selections of local (Talatuoya) tomato material were shown by tests at the Peradeniya Experiment Station to be significantly more resistant to bacterial wilt [*Bacterium solanacearum*] than three varieties imported from Australia, viz., Burwood Wonder, Excelsior, and Early Dwarf Red.

*Vermicularia* [*Colletotrichum*] *curcumae* [ibid., xi, p. 545] caused a leaf disease of turmeric grown from rhizomes imported from India. The fungus, not previously recorded in Ceylon, may very well have been present on the surfaces of the rhizomes before planting. Severely affected foliage was excised, and the plants sprayed with a copper fungicide.

A species of *Helminthosporium* was reported for the first time on Napier grass [*Pennisetum purpureum*: cf. ibid., xx, p. 426] in an up-country district.

Surat ginger plants raised from stock free from disease [*Pythium myriotylum*: ibid., xx, p. 290] in the laboratory compound have made luxuriant growth and continue to be healthy.

Belgrave (W. N. C.). **Report on agriculture in Malaya for the year 1940.**—14 pp., 1941.

In the section of this report [cf. *R.A.M.*, xix, p. 72; xx, p. 7] dealing with plant diseases (pp. 8–9) it is stated that observations on the stems of oil palms felled and allowed to die on the surface in a replanted area showed that most were still quite sound after four years. Replanting by felling and mounding to the crowns resulted in the palms making good progress, whereas the stems of some unmounded palms decayed as a sequel to infection by *Fomes noxius*.

Dwarf coco-nut palms showed leaf disease due to *Marasmius palmivorus* [ibid., xvii, p. 162].

**Annual Report of the Director of Plant Industry, Commonwealth of the Philippines, for the year ending December 31, 1938.**—221 pp., 29 pl., 1940. **Semi annual Report for the period from January 1 to June 30, 1939.**—220 pp., 25 pl., 1940.

Among the items of interest in the phytopathological sections of these reports (pp. 92–101 in the first and pp. 73–78 in the second) may be mentioned the following. Since May, 1937, a vigorous campaign for the eradication of abaca [*Musa textilis*] bunchy top [*R.A.M.*, xviii, p. 444], mosaic [ibid., xx, p. 465] and vascular wilt [*Fusarium oxysporum* var. *cubense*: ibid., xix, p. 707] has been in progress in Davao. Observations on 7,900 rootstocks of the bunchy top-resistant Putian variety in eleven localities in Cavite, Laguna, and Mindoro indicated that it may safely be cultivated in regions where the disease is prevalent. Mosaic is stated to be spreading widely and rapidly in Davao.

In October, 1938, Szinkom oranges at the Lipa Citrus Station were found to be infected by *Phytophthora citrophthora*, not hitherto reported from the Philippines, in combination with *Oospora citri-aurantii* and *Botrytis cinerea*.

Resistance to *Sclerotium* [? *rolfsii*] was shown in a groundnut varietal

trial by the progeny of a cross between the highly resistant Virginia Jumbo and the fairly susceptible Macapno.

A new bean [*Phaseolus vulgaris*] disease caused by a species of *Rhizoctonia*, possibly *R.* [*Corticium*] *microsclerotia* [cf. ibid., xix, p. 3], was responsible for severe damage in Davao in 1938.

Of the selections derived by hybridization from seed potatoes of Michigan origin for cultivation in the Baguio district, where late blight [*Phytophthora infestans*] is very serious, Baguio selection No. 8 has proved to be the most resistant, withstanding infection even under the humid conditions favouring the pathogen; selections Nos. 1–5 are slightly less resistant, but still commercially profitable even during the rainy season, while Nos. 6 and 7 are considerably more susceptible.

Glister (G. A.). **A new antibacterial agent produced by a mould.** *Nature, Lond.*, cxlviii, 3755, p. 470, 1941.

A mould, probably a species of *Aspergillus*, has been found to produce a powerful anti-bacterial agent with chemical properties different from those of penicillin [*R.A.M.*, xx, p. 484] and a much wider antibacterial range.

Riker (A. J.), Henry (B.), & Duggar (B. M.). **Growth substance in crown gall as related to time after inoculation, critical temperature, and diffusion.**—*J. agric. Res.*, lxiii, 7, pp. 395–405, 1941.

In a study on the part played by growth substances of the heteroauxin group in the formation of crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) [*R.A.M.*, xix, pp. 202, 560], no significant differences in auxin content were observed between inoculated and control tomato tissue 1, 4, 8, and 16 days after inoculation, especially when compared on a total nitrogen basis. There was half as much auxin in galls and control stems from decapitated tomatoes as in those from whole plants, although both kinds of plants had galls of a similar size. The auxin content of tomato stems grown at 27° C., when galls develop, did not differ significantly from those grown at 31°, when galls do not develop; nor did the auxin content diffusing from stems bearing galls differ significantly from that from control stems.

Reviewing the evidence regarding the pathogenic action of *Bact. tumefaciens*, the authors show that while the bacteria produce indoleacetic acid or a similar substance in cultures, and proliferation resembling crown gall tissue is induced by the application of extracts of crown gall tissue, or of cultures of the organism, or of beta-indole-acetic acid, this acid or some similar substance elaborated by the bacteria cannot be the factor responsible for the pathogenicity of *Bact. tumefaciens* for the following reasons. (1) Various non-pathogenic bacteria produce beta-indole-acetic acid or closely related substances; (2) a variety of extracts of plants and chemicals are capable of inducing proliferation in plants; (3) the concentrations of the growth-promoting substance in bacterial cultures and plant tissues are very much smaller than those of the chemicals employed for inducing pathological growth; and (4) some plants respond to beta-indole-acetic acid that are not susceptible to crown gall and some are susceptible to the latter that do not respond to the former. The writers conclude that, so far as they

are aware, *Bact. tumefaciens* is pathogenic independently of auxin production.

WILD (A. S.) & TEAKLE (L. J. H.). **Experiments with micro-elements for the growth of crops in Western Australia. II. Experiments on high level sandy and gravelly country in the southern Wheat belt.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xviii, 2, pp. 91–96, 1941.

Experiments carried out at Dumbleyung and Jilakin in Western Australia showed that beneficial results were obtained when copper sulphate was applied at the rate of 10 lb. per acre (in addition to superphosphate) to high-level, sandy and gravelly soils planted to wheat [*R.A.M.*, xx, pp. 352, 595]. In one experiment at Dumbleyung in 1940 the yield of the copper sulphate-treated plot was 8·2 bush. per acre compared with 4·9 bush. for a similarly treated plot but from which the copper sulphate was withheld. Growers experimenting with this type of land should apply a mixture of copper sulphate (about 5 lb. per acre) and superphosphate to strips across the area and compare the growth thereon with that on adjacent strips receiving superphosphate only. Bencubbin wheat grown on copper-deficient soil developed a large proportion of dummy heads, generally pale yellow, while a purplish discoloration of the straw and leaf sheaths was common, and there was a marked tendency towards the formation of secondary green tillers while the main plant was maturing.

TEAKLE (L. J. H.) & BURVILL (G. H.). **Experiments with micro-elements for the growth of crops in Western Australia. IV. Experiments at Muchea and Maida Vale.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xviii, 2, pp. 125–132, 1941.

In fertilizer experiments carried out in the neighbourhood of the Perth metropolitan area, Western Australia, on diatomaceous swamp soil, semi-swamp, and poor sandhill country the value of copper compounds, included in the fertilizers, was proved for a number of crops, including maize, Sudan grass [*Sorghum sudanense*], oats, and Japanese millet [*Echinochloa crus-galli*]. In one test with four fertilizer mixtures, namely, (*a*) 12 cwt. per acre potato manure for potatoes and 3 cwt. for maize, Japanese millet, and Sudan grass, (*b*) the same plus 18 lb. copper sulphate per acre, (*c*) as for (*a*) plus 18 lb. manganese sulphate per acre, and (*d*) as for (*a*) plus 18 lb. copper sulphate, 18 lb. manganese sulphate, and 6 lb. zinc sulphate per acre, potatoes grown without manganese showed a yellowish-green foliage and an unthrifty top growth. Maize grown without copper was only 18 in. tall after about three months, and showed a striped chlorosis, in addition to characteristic leaf-tipping. Some of the leaf tips died before emergence, and remaining trapped in the leaf sheaths, gave the plants a distorted appearance. With copper additions, the plants appeared normal, and were 30 to 40 in. tall. Where copper was not used, internodal stem elongation was restricted, and the leaves trailed on the ground, giving the plants a conifer-like shape. The growth of the maize was slightly improved by manganese alone and in combination with copper. Millet gave a less consistent response to copper. In the absence of this metal, the growth of Sudan grass was poor and tussocky, and leaf tipping

was severe. Only a few plants produced even small heads, and they were only about 1 ft. high. In the presence of copper, the plants grew normally, and headed out at a height of 3 to 5 ft.

In a test on moist land in the Maida Vale district oats grown without copper yielded 2·9 cwt. of straw per acre, as against 5·4 cwt. for plots receiving copper sulphate (20 lb. per acre).

RICEMAN (D. S.) & ANDERSON (A. J.). **Response to zinc on a South Australian soil.**—*J. Aust. Inst. agric. Sci.*, vii, 2, p. 82, 1941.

In an experiment at Robe, South Australia, the yield of Mulga oats growing on loose sand dunes amounted to 10·6 bush. grain and 20·9 cwt. straw per acre when copper sulphate was applied at the rate of 56 lb. per acre, and to 18 bush. grain and only 15·1 cwt. straw when zinc sulphate was also added at the rate of 28 lb. per acre [see preceding abstracts]. Subsequent tests confirmed this result, and excellent crops and pastures were obtained by the addition of zinc to the superphosphate-copper sulphate fertilizer.

LUTHRA (J. C.). **Solar treatment of Wheat loose smut.**—*Indian Fmg*, ii, 8, pp. 416–418, 1 pl., 1941.

Since 1929 the writer has been investigating the possibilities of combating loose smut of wheat (*Ustilago tritici*) in the Punjab by means of solar heat [*R.A.M.*, xiv, p. 23]. In experiments at the Lyallpur Agricultural College and Research Institute, of a number of combinations of several hours 'pre-soaking' in water and varying periods of exposure to the sun, the most effective proved to be four hours of each treatment, which resulted in a perfectly sound crop, with no reduction of germination, whereas the incidence of infection in the untreated samples ranged from 5 to 15 per cent. The best months for the application of the solar treatment are May and June, when the maximum shade temperature reaches 120° F., or before the onset of the rains about mid-July; satisfactory control has been achieved at later dates up to September (temperature 104°), but under the conditions then prevailing success cannot be guaranteed. However, even in the moderately hot climate of Gurdaspur (shade temperature in July 102°), a crop raised from treated seed contained only 0·3 per cent. smutted heads compared with 18 per cent. in a stand grown from an untreated sample.

MIDDLETON (J. T.). **Root rot of Barley caused by Pythium hypogynum n.sp.**—Abs. in *Phytopathology*, xxxi, 9, p. 863, 1941.

*Pythium hypogynum* n.sp. is described [without a Latin diagnosis] as producing an irregularly septate mycelium, 1·5 to 8·3, average 5·1 $\mu$ in diameter; terminal, rarely intercalary, subspherical to spherical, smooth, thin-walled sporangia, 6·5 to 34·6 (average 22·1) $\mu$; terminal, subspherical to spherical oogonia, 10·2 to 35·1 (22·0) $\mu$; a single hypogynous antheridium, delimited within the oogonial stalk at a distance ranging from 5 to 30 $\mu$ below the oogonium, the antheridial cell measuring 3 to 11·1 by 2·8 to 8·3 (6·6 by 5·4) $\mu$; and plerotic oospores containing a single reserve globule and a prolate ellipsoidal or flattened refringent body; germination was not observed. The fungus causes a

root rot of barley in poorly drained soils in Missouri, manifested by discoloration and flaccidity of the cortical tissues and stunting and chlorosis of the shoots. Diseased plants rarely stool or produce heads. Isolates of *P. hypogynum* from infected roots were experimentally shown to be pathogenic.

HOYMAN (W. G.). **Concentration and characterization of the emetic principle present in Barley infected with Gibberella saubinetii.**—*Phytopathology*, xxxi, 10, pp. 871–885, 1 diag., 1941.

A detailed, tabulated account is given of the writer's studies at the Iowa State College on the nature of the principle in barley infected by *Gibberella saubinetii* which induces emesis in pigs [*R.A.M.*, xvii, p. 657]. The substance was extracted from infected grain with water over a wide temperature range. It was resistant to drying but was partly inactivated by autoclaving. Methyl alcohol was an efficient solvent of the principle from concentrated aqueous extracts and further purification of the soluble material was obtained by extraction with ether. Analysis indicated the presence of nitrogen but no sulphur or halogens. It is concluded that the substance may be an alkaloid but the evidence is insufficient to warrant that conclusion.

SCHWEIZER (G.). **Über die Kultur von Claviceps purpurea (Tul.) auf kaltsterilisierten Nährböden.** [On the cultivation of *Claviceps purpurea* (Tul.) on cold-sterilized nutrient media.]—*Phytopath. Z.*, xiii, 4, pp. 317–350, 12 figs., 1941.

A comprehensive account is given of the writer's method of obtaining sclerotia of *Claviceps purpurea* in pure culture [*R.A.M.*, xix, p. 273; xx, p. 76] at the Institute of Agriculture and Plant Breeding, Giessen, Germany. The rye seeds (the use of barley or wheat for the purpose entails the incorporation of special adjuncts with the medium and is not further considered here), after thorough washing in cold, running water and stirring to remove particles of dirt and dust, are packed in a thick layer in a covered vessel at 20° C. to germinate, the process being interrupted as soon as a grain's length is attained, when the embryos and radicles, with the addition of a few drops of carbon disulphide, are passed several times through a mincing-machine to produce a thin broth. This in turn is pressed with a wooden pestle through a fine sieve until the correct consistency for easy spreading is reached. The resultant emulsion is then thoroughly mixed with an antiseptic, e.g., carbon disulphide plus ethyl chloride, methyl chloride plus ethyl chloride, or petrol ether plus ethyl chloride at the rate of 1 c.c. per 150 gm., the antiseptics being blended in such a way as to give a boiling point of 27°. The sterilized emulsion is poured into glass dishes which are left covered for an hour, whereupon the antiseptic is removed by means of the vacuum engendered by the cold sterilization apparatus (described in the author's 'Einführung in die Kaltsterilisationsmethode', G. Fischer, Jena, 1937), and ascospores immediately transferred to the medium. These organs are best obtained from three months- to one-year-old sclerotia, sterilized by a dip in a 1 in 5,000 solution of iodine, 3 per cent. hydrogen peroxide, or 0·1 to 0·3 per cent. quinosol, placed after washing in sterile distilled water on damp sand in glass containers

in a refrigerator for 20 to 25 days (or exposed to frost in winter), returned to a temperature of 15° to 20°, and inoculated with pollen from flowering rye or preferably with an ethereal or aqueous solution of the same. The pollen carries a 'contagium' which stimulates the germination of the sclerotia. This 'contagium' comprises one or more specific substances, which are water-soluble and thermostable. Under these conditions fruiting begins after three to five days, and in order to obtain a plentiful supply of ascospores the brick- to dark-red heads of the perithecia are transferred to slides smeared with saccharose or dextrose agar in a moist chamber exposed to the light, where forcible expulsion commences within an hour. The ascospores may then be removed with a layer of agar to the above-mentioned rye emulsion.

Germination takes place rapidly, the conidial (*Sphacelia*) stage requiring an acid reaction for its development and the sclerotia an alkaline one, the latter being recognizable by the odour of trimethylamine coinciding with the inception of honey dew production at the close of the conidial phase. The close mutual relationships subsisting between the metabolism of the fungus and the enzymatic reactive activity of the medium are to some extent comparable with the relation of the parasite to its host in nature, and the associated automatic development of alkalinity in the cold-sterilized cultures is a prerequisite condition for sclerotial production.

The sclerotia obtained by this method are anatomically similar to those developing under natural conditions, while their alkaloid content (average of 0·279 per cent.) approximates to that of the best commercial brands of the drug.

MORWOOD (R. B.). **Seed treatment of Sorghums.**—*Qd agric. J.*, lvi, 3, p. 232, 1941.

Wheatland milo sorghum seed-grain artificially inoculated with *Sphacelotheca sorghi* [*R.A.M.*, xxi, p. 10] and treated with copper carbonate, mercurial dust A, mercurial dust B, cuprous oxide, and mercurial dust C, each applied at the rate of 2 oz. per bush., gave, respectively, 0·4, 0·4, 0·8, 2·8, and 9·0 per cent. infected heads, as against 10·8 per cent. for the untreated control seed.

ULLSTRUP (A. J.). **Inheritance of susceptibility to infection by Helminthosporium maydis race 1 in Maize.**—*J. agric. Res.*, lxiii, 6, pp. 331–334, 1 fig., 1941.

In further studies [*R.A.M.*, xx, p. 526] of *Helminthosporium maydis* [considered to be the conidial stage of *Ophiobolus heterostrophus*: ibid., v, p. 293], crosses between the inbred line *Pr* and *Hy*, 38–11, and *Tr*, respectively, were studied during 1939 for inheritance of resistance to race 1 of the fungus. The results indicate that resistance and susceptibility to this race are conditioned by a single pair of genes, which are designated as Hm and hm. In heterozygous individuals resistance is completely dominant. The line *Pr* is stated to be the only known source of the recessive allelomorph for susceptibility, all crosses studied showing no other than typical monogenic inheritance.

Ho (W. C.). **Soil-inhabiting fungi attacking the roots of Maize.**—*Iowa St. Coll. J. Sci.*, xvi, 1, pp. 72–74, 1941.

In greenhouse and field inoculations at the Iowa State College with various fungi isolated from maize roots, the pathogenicity of *Pythium de Baryanum* and *Helminthosporium sativum* to that host [*R.A.M.*, xx, p. 357] was established for the first time. The former developed early in the growing season and caused necrosis of the fine rootlet tips, while the latter appeared on the diseased roots and mesocotyls midway through the vegetative period. *P. de Baryanum* became less destructive as the soil temperature rose, whereas warmer conditions favoured *P. graminicola* and enabled it to cause rapid necrosis and a brown, water-soaked appearance of the root tips. At the same time, *Gibberella saubinetii* and *Rhizoctonia* [*Corticium*] *solani* were frequently observed on the lower part of the mesocotyl, subsequently inducing discoloration and cortical necrosis of the roots. Later *Penicillium oxalicum* and other organisms besides *H. sativum* produced further necrosis of the mesocotyl and basal part of the roots. Still later, *Fusarium moniliforme* [*G. fujikuroi*], *Aspergillus niger*, *Trichoderma lignorum* [*T. viride*], which tended to suppress its competitors [ibid., xix, p. 589 *et passim*], and *F.* spp. developed in the root lesions, while *Diplodia zeae*, *P. oxalicum*, *A. niger*, and *F.* spp. were present in abundance on the crowns of ripe plants, to the exclusion of the organisms encountered in the early stages of growth.

Of the 14 open-pollinated varieties studied for their reactions to *Pythium de Baryanum* and *P. graminicola*, Kossuth County Reliance and Stem Yellow Dent were susceptible and Black Yellow Dent and Krug more resistant. Among 15 inbreds, only Ldg (k), Black 349, Lancaster 289, Osterland 426, and Hy showed some degree of resistance. Single crosses representing combinations of less susceptible inbreds proved resistant to both species of *Pythium*, the same being true of the Iowa hybrids. In general, infection became more severe in plants held for ten days at 8° prior to transference to a temperature of 22° to 27° than in those kept continuously under the latter conditions, exceptions to this rule being Triple Dent, Silver Dent, Silver King, and Gold Mine, which suffered more severely at uninterrupted higher temperatures.

Seed treatment, which was particularly effective at low temperatures, reduced the disease ratings of susceptible varieties, inbreds, and double crosses by from 22 to 69, 34 to 83, and 26 to 60 per cent., respectively.

Edwards (E. T.). **Internal grain infection in Maize due to Gibberella fujikuroi and Gibberella fujikuroi var. subglutinans.**—*J. Aust. Inst. agric. Sci.*, vii, 2, pp. 74–82, 2 figs., 1 graph, 1941.

Laboratory experiments carried out at Madison, Wisconsin, demonstrated that little if any internal grain infection by *Gibberella fujikuroi* [see preceding abstract] or *G. fujikuroi* var. *subglutinans* could be established in mature ears of maize maintained in a warm, moist atmosphere for three days before, and four after, inoculation, though there was a slight increase in the incidence of naturally occurring internal grain infection.

In field tests, a high incidence of internal grain infection by both fungi resulted when the ears were inoculated (1) just after pollination, (2) five or six days after pollination, (3) 12 to 15 days after, (4) at the dent stage, and (5) when the grain was almost mature. The highest incidence of infection occurred when the ears were inoculated between pollination and the dent stage. Injury to the husk and the maintenance of the ear in moist atmosphere afterwards were important factors conducing to the establishment of infection. Ears so treated between pollination and the dent stage showed much kernel rot, though such rot seldom developed unless the grain had been injured.

Cummins (G. B.). **Identity and distribution of three rusts of Corn.**—*Phytopathology*, xxxi, 9, pp. 856–857, 1 fig., 1941.

A specimen of leaf rust of maize collected by E. C. Stakman in Peru and labelled *Puccinia sorghi* was found on examination to be quite a distinct species, characterized by irregular, usually angular, chestnut-brown teleutospores, 29 to 41 by 19 to 27 $\mu$, with an only slightly thickened apical wall, in contrast to the much thickened apex of *P. sorghi* [*P. maydis*], and yellowish or golden uredospores, 29 to 36 by 21 to 29 $\mu$, furnished with four or five poorly defined equatorial pores; mesospores were present in abundance. The species was identified as *P. polysora*, previously reported on maize from the United States, the earliest record (1879) being from Massachusetts, British Honduras, Costa Rica, Cuba, Guatemala (also on *Euchlaena mexicana*), Mexico, Panama, Puerto Rico.

*Angiopsora zeae* [*R.A.M.*, xvii, p. 452] is somewhat similar to *P. polysora* in the uredo stage, but the sori of the former tend to occur in small groups while its uredospores are not only smaller (22 to 30 by 16 to 20 $\mu$), but more finely echinulate and subhyaline. The teleuto stage is readily distinguishable by the catenulate, unicellular spores, usually two to each sessile chain. *A. zeae* has been recorded on maize from the United States, Guatemala, Puerto Rico, Santo Domingo, and Trinidad.

Woglum (R. S.) & Lewis (H. C.). **Grapefruit damage from Septoria.**—*Calif. Citrogr.*, xxvi, 12, pp. 367, 394, 1 fig., 1941.

During the past season, severe spotting was caused to grapefruit in California by *Septoria* [? *citri*]. The disease has been present locally for many years, but has recently become of increasing importance, probably owing to a succession of wet, warm winters, followed by humid weather in spring. Severe damage has been caused in most parts of central and southern California, and Valencia oranges have also been affected, mostly in the central districts. Spotting often takes the form of tear stains or streaks, the spots being dark brown or black, depressed, with a narrow, greenish margin, and ranging in size from scattered stippling to almost continuous large, deep pits.

Spraying should be carried out in late November or December, using a mixture composed of 1 lb. copper sulphate, 5 lb. zinc sulphate, and 4 lb. hydrated lime per 100 gals. water. The cost should not exceed 10 to 15 cents per tree. Treatment in February or March, after the disease has already appeared, has arrested any further development.

In central California, where zinc-lime whitewash is used against insect infestation, 1 lb. copper sulphate per 100 gals. water should be added if protection against *Septoria* infection is desired.

FAWCETT (H. S.) & COCHRAN (L. C.). **Resistance of Citrus tissue and psorosis virus A to heat.**—Abs. in *Phytopathology*, xxxi, 9, p. 861, 1941.

The results of five separate trials between 1936 and 1940, in which bud wood of Valencia orange from trees affected by psorosis A (*Citrivir psorosis* var. *vulgare*) [*R.A.M.*, xx, p. 360] were immersed in water heated to different constant temperatures prior to the insertion of their buds into virus-free nursery trees, indicated that this method is unlikely to be of practical value in the control of the disease. Only in three trees out of the 130 in which the buds remained alive in the 1940 test, for instance, did foliar symptoms fail to develop.

CALDWELL (N. E. H.) & BLACKFORD (F. W.). **Control schedules for Citrus pests and diseases in south-eastern Queensland.**—*Qd agric. J.*, lvi, 2, pp. 117–120, 1941.

A spray programme in tabulated form is presented for the control of various citrus pests and diseases in south-eastern Queensland, giving the different combinations of diseases controlled by the same treatment, time of application, dosage, and the varieties affected.

FRANCO DO AMARAL (S.). **A poda da Laranjeira no tratamento da leprose.** [Pruning of the Orange in the treatment of leprosis.]—*Biologico*, vii, 7, pp. 183–186, 4 figs., 1941.

Full directions are given for the drastic pruning of orange trees suffering from leprosis in Brazil [*R.A.M.*, xx, p. 530]. The method involves the removal by sawing, preferably from the end of May to mid-June, of all the main branches, leaving only those with a diameter of 2 to 3 in., from which all the buds are stripped with the exception of two or three per branch. It is advisable to apply to the bark thus exposed a coating of lime or Bordeaux mixture, the latter acting not only as a protectant against sun scorch but also as a disinfectant. A more conservative method of pruning, in which only the green branches are excised, is less suitable for large-scale use, but may be practised in small plantations where the loss of one or more harvests, incidental to the drastic treatment, would entail undue hardship.

YOUNG (V. H.) & THARP (W. H.). **Relation of fertilizer balance to potash hunger and the Fusarium wilt of Cotton.**—*Bull. Ark. agric. Exp. Sta.* 410, 24 pp., 3 graphs, 1941.

In investigations conducted in Arkansas from 1937 to 1939, the cotton varieties Cook, Rowden 2088, and Half & Half were planted on fine alluvial soil in which cotton in earlier years had been seriously infected with *Fusarium* wilt [*F. vasinfectum*: *R.A.M.*, xviii, p. 452] and had shown marked symptoms of potash deficiency (rust) [ibid., xix, p. 403; xx, p. 300]. Nine different fertilizer treatments, based on 600 lb. of 6–8–6 (nitrogen, phosphorus, potassium) fertilizer per acre were tested, the proportions of the elements being varied to provide a series of complete and incomplete fertilizer combinations.

The mean wilt intensities for the three varieties during the whole period were 2·74, 6·03, and 55·66 per cent., respectively. The effect of any treatment on any one variety was, however, similar to that on the other two.

Thus, combinations with the least amount of potash (6–12–4) gave effective control of 'rust' and conspicuously reduced wilt. The heaviest amounts of potash (6–12–12 and 0–4–12) gave the best control of wilt. Unbalanced applications (unfertilized controls, 6–8–0, and 0–8–0) increased wilt and induced pronounced 'rust'. Phosphate used alone caused increased wilt, as compared with the non-fertilized controls. All the fertilizers except phosphate alone (0–8–0) gave highly significant yield increases on Half & Half. The highest potash application (6–12–12) gave better results than one in which the amount of potash was reduced to one-third of this amount.

Under the conditions of the experiment, potash applications gave definite control of 'rust' (potash hunger) and very marked control of wilt, whereas high applications of nitrogen and phosphate, and of phosphate without potash were either ineffective or detrimental.

Increased susceptibility to attacks of *F. vasinfectum* was associated with increased severity of potash-deficiency symptoms.

GREATHOUSE (G. A.) & RIGLER (N. E.). **Alkaloids from Zephyranthes texana, Cooperia pedunculata and other Amaryllidaceae and their toxicity to Phymatotrichum omnivorum.**—*Amer. J. Bot.*, xxviii, 8, pp. 702–704, 1941.

The alkaloid lycorine, present in the bulb and root tissues of *Zephyranthes texana* and *Cooperia pedunculata* in concentrations of 0·02 and 0·04 to 0·05 per cent., respectively, of the fresh weight, was shown in tests at the Texas Agricultural Experiment Station to prevent the growth of *Phymatotrichum omnivorum*, the agent of root rot [of cotton and other crops: *R.A.M.*, xviii, p. 24], at a strength of 0·003 per cent., while a second alkaloid, presumed to be ψ-lycorine, isolated from the mother liquors of *C. pedunculata* at a concentration of approximately 0·002 per cent., acted similarly on the fungus at a strength of 0·0045 per cent. The total quantities of lycorine and ψ-lycorine present in *Z. texana* and *C. pedunculata*, respectively, were about 7 and 15 times as much, respectively, as was necessary to inhibit the development of *P. omnivorum*. Various organs, notably the peripheral bulb scales, the shortened stem, and the roots, of 11 other species of Amaryllidaceae were also found to contain alkaloids which are thought likely to contribute to the established immunity from root rot of members of this family.

BLANK (L. M.) & TALLEY (P. J.). **Are ammonium salts toxic to the Cotton root rot fungus?**—*Phytopathology*, xxxi, 10, pp. 926–935, 1 graph, 1941.

No evidence was obtained in the writers' further studies at the Texas Agricultural Experiment Station on the action of several concentrations ranging from 0·0063 to 0·075M of ammonium sulphate and ammonium phosphate on cultures of the cotton root rot fungus, *Phymatotrichum omnivorum*, in a synthetic nutrient solution [*R.A.M.*,

xx, p. 256], that the toxicity of these compounds to the pathogen is a property of the ammonium ion. An acid condition, inhibiting further growth, rapidly develops in improperly constituted nutrient solutions with ammonium salts as the nitrogen source: this may be prevented by the addition of calcium carbonate in the proper amount to result in a 0·0125M concentration in the final volume. Ammonium nitrogen was found to provide a good source of nitrogen for *P. omnivorum* in soil cultures, no evidence of toxicity being observed with concentrations up to 0·075M. These data suggest that the beneficial effects of the treatment of diseased plants with ammonium compounds represent a response to the reception of additional supplies of available nitrogen rather than a reduction in the virulence of the pathogen, and it is doubtful, therefore, whether permanent eradication and control can be achieved by the use of ammonium salts.

**Studies on the root-rot disease of Cotton in the Punjab.**

LUTHRA (J. C.), VASUDEVA (R. S.), & ASHRAF (M.). **VIII. Further studies on the physiology of the causal fungi.**—*Indian J. agric. Sci.*, x, 4, pp. 653–662, 1940.

LUTHRA (J. C.) & VASUDEVA (R. S.). **IX. Varietal susceptibility to the disease.**—loc. cit., xi, 3, pp. 410–421, 1941.

VASUDEVA (R. S.) & SIKKA (M. R.). **X. Effect of certain fungi on the growth of root-rot fungi.**—loc. cit., xi, 3, pp. 422–431, 2 pl., 1 diag., 1 graph, 1941.

In further studies at the Lyallpur (Punjab) Agricultural Research Institute on the root rot of cotton caused by *Macrophomina phaseoli* and *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xix, p. 90], all the carbohydrates tested, viz., maltose, glucose, sucrose, lactose, galactose, dextrin, and soluble starch, supported fairly abundant growth of both fungi, agar media being more favourable than liquid substrata both for growth and for rapid acidification, which does not occur, however, in the case of *M. phaseoli*, when lactose or galactose provide the source of carbon. Floating cultures on a liquid synthetic medium grew almost as quickly as those on agar, whereas in submerged cultures development was slow and acidification retarded. A depressing effect on growth and delay in acidification was further exerted on both fungi by carbon dioxide at concentrations of 20 per cent. and upwards, *C. solani* being the more sensitive of the two in this respect, while *M. phaseoli* reacted similarly to an atmosphere of pure oxygen; on the other hand, pure nitrogen and a 50 : 50 mixture of nitrogen and oxygen did not appreciably inhibit growth or retard acidification.

None of the large number of native and foreign varieties and strains of cotton tested from 1937 to 1939 for their reaction to the root-rotting pathogens gave evidence of any significant degree of resistance, while selfed seeds of apparently healthy individuals in infected plots did not give rise to resistant plants.

The presence of *Trichoderma lignorum* [*T. viride*] and *Aspergillus niger* in cultures of *M. phaseoli* and *C. solani* on various synthetic and natural media greatly restricted the growth of the cotton root rot fungi [ibid., xii, p. 192; xix, p. 259, *et passim*], the hyphae of which undergo

lysis on coming into contact with those of the inhibitors. The activity of filtrates of *M. phaseoli* and *C. solani* was likewise reduced by the admixture of *T. viride* and *A. niger* with the cultures, the times required for the wilting of plants by filtrates of *T. viride*+*M. phaseoli*, *T. viride*+*C. solani*, *A. niger*+*M. phaseoli*, and *A. niger*+*C. solani* being 270, 270, 300, and 300 minutes, respectively, compared with 180 and 60, respectively, for *M. phaseoli* and *C. solani* alone.

DRECHSLER (C.). **Predaceous fungi.**—*Biol. Rev.*, xvi, 4, pp. 265–290, 1941.

The author summarizes his own work to date on predaceous fungi at the United States Horticultural Station, Beltsville, Maryland [*R.A.M.*, xxi, p. 15], and critically discusses that of other workers in the same field.

MARCHIONATTO (J. B.). **'Acrostalagmus aphidum' hongo parásito de los Pulgones.** [*Acrostalagmus aphidum*, a fungus parasitic on Aphids.]—*Physis, B. Aires*, xix, pp. 51–54, 2 figs., 1941.

*Acrostalagmus aphidum* [*R.A.M.*, viii, p. 641], collected from aphids on carnations at an Argentinian plant quarantine station, is stated to be readily cultivable on standard media. On potato agar with 1 per cent. glucose the white, later cream-coloured, cottony mycelium, 2·5 $\mu$ in diameter, branches dichotomously, the erect, septate fertile hyphae, generally trifurcate at the apex, giving rise to gregarious or solitary, acicular, continuous, hyaline conidiophores, 14 to 18 $\mu$ in length, from the apices of which are abstricted 8 to 11 straight, cylindrical, ovoid, or cylindrical to oval conidia, 5 to 12 by 2 to 2·5 $\mu$. Germination takes place with the greatest rapidity in a 2 per cent. glucose solution. Reference is briefly made to Petch's observations on the taxonomic relationships between *Cephalosporium* and *Acrostalagmus* [ibid., v, p. 97].

SMITH (F. G. W.). **Sponge disease in British Honduras, and its transmission by water currents.**—*Ecology*, xxii, 4, pp. 415–421, 1 fig., 2 maps, 1941.

Commercial sponges, mostly of the species *Hippiospongia lachne* and *H. gossypina*, in the Turneffe lagoon, British Honduras, sustained extensive damage during the summer of 1939 from the attacks of an unidentified fungus corresponding in all respects to the agent of a similar epidemic in the Bahama Islands in the previous winter. The hyaline, amorphous filaments of the organism measure 1 to 2 $\mu$ in diameter, and usually occur in groups, one end being attached to the dead sponge fibre and the other free. Out of 45 sponges examined from widely separated areas of the lagoon, 42 revealed the presence of the fungus, which is believed to have been carried from the Bahamas to Turneffe by means of water currents.

SOKOLOFF (V. P.) & KLOTZ (L. J.). **Mortality of the red scale on Lemons through infection with a spore-forming bacterium.**—Abs. in *Phytopathology*, xxxi, 9, p. 864, 1941.

Adult females of *Aonodiella aurantii* on lemons were destroyed to

the extent of 100 per cent. under controlled laboratory conditions by contact with a denitrifying bacterium isolated from the soil and provisionally designated *Bacillus* 'C', mass infection of the 7,000 insects used in the tests being secured by immersion, spraying, or dusting with the spores of the organism. Symptoms of the bacterial disease included gas production, distortion of the pygidia, and a characteristic brown discoloration of the insects, followed by disintegration and drying. The *Bacillus* was detected in smear preparations from diseased and dead scales, extracts from which contained little or no nitrate in contrast to the measurable amounts present in healthy insects. It is a large, motile, Gram-positive rod, forming spores in the equatorial position. Though normally aerobic, it is capable of anaerobic growth in the presence of nitrate or nitrite on various organic substances, including chitin.

WHITE (R. T.). **Development of milky disease on Japanese Beetle larvae under field conditions.**—*J. econ. Ent.*, xxxiv, 2, pp. 213–215, 1941.

Data are presented indicating the importance of milky disease (*Bacillus popilliae* and *B. lentimorbus* Dutky) as a natural control agency in areas supporting heavy populations of Japanese beetle (*Popillia japonica* Newm.) larvae [*R.A.M.*, xx, p. 114 and next abstract]. Observations in selected areas in New Jersey, Maryland, and Washington, D.C., in 1939–40 showed a rapid build-up of disease, followed by a corresponding decrease in the insect population. Thus, in one such inspection the population of beetles per sq. ft. on 24th August, 1939, was 37, and of 366 larvae 4 per cent. were diseased, while by 17th June, 1940, the population had sunk to 6·3 per sq. ft., and of 382 larvae 67 per cent. were infected.

DUTKY (S. R.). **Susceptibility of certain Scarabaeid larvae to infection by type A milky disease.**—*J. econ. Ent.*, xxxiv, 4, pp. 215–216, 1941.

In addition to *Popillia japonica*, the following Scarabaeid larvae were shown by inoculation tests to be susceptible to infection by type A milky disease (*Bacillus popilliae*) [see preceding abstract]: *Anomala orientalis* Waterhouse, *Autoserica castanea* Arr., *Cyclocephada borealis* Arr., *Phyllophaga auxia* Le C., *P. bipartita* Horn, *P. ephilida* (Say), *P. fusca* Frohl., *P. rugosa* Melsh., *Strigoderma arboricola* (F.), and *Strigodermella pygmaea* (F.).

[A further paper by the same writer on pp. 217–218 gives full directions for laboratory and field tests of the potential value of *B. popilliae* and *B. lentimorbus* in the control of soil-inhabiting larvae.]

SERRANO (M.). **Über die Systematik von 18 aus verschiedenen Krankheitsprozessen der menschlichen Haut gewonnenen Sprosspilzen.** [On the taxonomy of 18 yeasts isolated from various pathological conditions of the human skin.]—*Z. Parasitenk.*, xii, 1, pp. 1–35, 46 figs., 1941.

Of the 18 yeast-like fungi isolated over a four-year period from various human disorders, mostly of the skin, at the Dermatological Clinic of Bonn University and cultured on a number of standard media, three are referred to *Candida triadis* [*C. albicans*: *R.A.M.*, xix, p. 535]

and one to each of the following: *C. tropicalis*; a variety of the same species differing from the type in its inability to ferment maltose and saccharose; *C. flareri* [loc. cit.]; *C. albicans*; *Mycotorula unguis* (Weil & Gaudin 1919); *Kloeckeraspora apiculata*; a new race *Zygopichia peptoni* of *Z. alcoholophila*; a new [unnamed] species of *Saccharomyces*; *Rhodotorula mucilaginosa* var. *pararosea*; *M. azymatica* n.sp., characterized by its inability to ferment any of the six sugars tested; *Torulaspora alkoholi* n.sp., which produced substantial amounts of alcohol in grape must (6·04 vol. per cent.) and fermented only glucose; a variety (*azymatica*) of the foregoing, utilizing none of the sugars; one to *Torulopsis glycosi* n.sp., assimilating glucose only; and a new [unnamed] variety of *R. rosae*. Each fungus is described from the cultural, morphological, physiological, diagnostic, and taxonomic standpoints. [No Latin diagnoses are given.]

Gill (W. D.). **Mycotic infections of the respiratory tract.**—*Trans. Amer. Acad. Ophthal. Oto-laryng.*, *1941*, 2, pp. 108–116, 1941.

This is a review, followed by a bibliography of 67 titles and a discussion (pp. 116–119), of the available information concerning the relation of various groups of fungi to diseases of the respiratory tract.

Moore (M.). **Histoplasma capsulatum: its cultivation on the chorio-allantoic membrane of the developing Chick and resultant lesions.**—*Amer. J. trop. Med.*, xxi, 5, pp. 627–642, 3 pl., 1941.

At the Barnard Free Skin and Cancer Hospital, St. Louis, Missouri, the author successfully inoculated the chorio-allantoic membrane of developing chicks [*R.A.M.*, xx, p. 258] with a seven-year-old culture of *Histoplasma capsulatum*. On this substratum the fungus undergoes a gradual conversion from the saprophytic stage characteristic of its development in pure culture to the parasitic phase, represented by yeast-like cells [ibid., xx, p. 578], indicating that the stalagmospores, aleuriospores, or ascus-like cells formed on an artificial medium are probably asci of a degenerate type.

Sproule (W. H.). **The yeast and mold service in relation to quality improvement.**—*Canad. Dairy Ice Cr. J.*, xx, 1, p. 50, 1941. [Abs. in *J. Dairy Sci.*, xxiv, 10, p. A 273, 1941.]

The larger Canadian creameries have recognized for a considerable period that butter with a low yeast and mould content is likely to keep better in storage than samples prepared with less stringent sanitary precautions. In a review of eight years progress, D. B. Shutt states that in 1928, 34·8 per cent. of the samples submitted for inspection showed counts of ten yeasts or under per c.c., as compared with only 1·2 per cent. in 1921, the corresponding figures for moulds [*R.A.M.*, xxi, p. 17] being 89·9 and 61·8 per cent., respectively.

Sutton (W. S.). **Irradiation of cheese moulds and bacteriophage by ultra violet light.**—*J. Aust. Inst. agric. Sci.*, vii, 2, pp. 67–73, 1 fig., 1941.

Experiments made to determine the effect of ultra-violet light on moulds developing on cheese rind in the curing process showed that

plates of wort agar exposed to air-borne contamination and then submitted to the light of gas-filled lamps containing mercury vapour for 4 to 16 minutes at a distance of 3 in. gave considerably fewer mould colonies than unexposed plates. The humidity of the surface and preliminary incubation did not affect the results. After incubation for 18 hours and subsequent irradiation, no germination of spores of *Penicillium* sp. and *Cladosporium* sp. occurred, but after 21 and 24 hours' incubation, respectively, germ-tubes were present, and in this stage ten minutes' irradiation caused death. In the pre-germination stage, some spores of both fungi survived ten minutes' irradiation.

When spore suspensions of *Oidium*, *Penicillium* (from cheese rind), *Hormodendron*, *Macrosporium*, *Cladosporium*, and *Aspergillus* were irradiated for periods ranging from five minutes to two hours, susceptibility to destruction was 'in the order named'. The *Aspergillus*, which belonged to the *niger* group, showed development in seven droplets after one hour's irradiation, and only in one droplet after two hours'.

When a newly prepared sugar suspension of *Penicillium* spores from cheese streaked on plates of potato dextrose agar was irradiated for 17 hours at distances of 3, 12, and 72 in. from the light, no growth occurred at 3 or 12, and only very scanty growth at 72 in.; all the controls grew perfectly.

WILLINGHAM (J. J.). **Action of mold inhibitors on dairy products.**—*Iowa St. Coll. J. Sci.*, xvi, 1, pp. 152–154, 1941.

Propionic acid was the most effective of the various compounds tested at the Iowa State College for the control of moulds (*Penicillium roqueforti*, *P. camemberti*, and *Oospora lactis*) in dairy products [*R.A.M.*, xx, p. 173], exerting an inhibitory action on the growth of the organisms at 0·5 to 1 per cent. both in raw milk or cream and in pure cultures in Czapek's medium. Other compounds giving moderately satisfactory results were calcium and sodium propionates and sodium benzoate.

FLOR (H. H.). **Inheritance of rust reaction in a cross between the Flax varieties Buda and J. W. S.**—*J. agric. Res.*, lxiii, 7, pp. 369–388, 3 figs., 1941.

In greenhouse tests conducted from 1934 to 1939 at the North Dakota Agricultural Experiment Station on the inheritance of factors determining the reaction of flax varieties to rust (*Melampsora lini*) [*R.A.M.*, xix, p. 655], Buda (immune from races 7 and 20 of the rust identified from North and South American collections; resistant to races 1, 5, 6, 10, and 11; semi-resistant to races 3, 14, 15, 17, 18, and 23; moderately susceptible to races 2, 9, 12, 13, and 24; and susceptible to races 4, 8, 16, 19, 21, and 22) was crossed with J.W.S. (immune from 18 out of the 24 races and susceptible to the remaining races 7, 9, 13, 15, 16, and 21). The $F_1$ generation was immune from all races from which either parent was immune, indicating that immunity was dominant. In the $F_2$, susceptible genotypes were identified. In the $F_3$, lines attacked by race 7 were homozygous for immunity from races 3 and 4 and, conversely, those attacked by race 3 or 4 were homozygous for immunity from race 7; lines homozygous for susceptibility to race 4

approximated a ratio of 1 semi-resistant to 2 heterozygous to 1 susceptible to race 3, and lines immune from race 4 a ratio of 1 resistant to 2 heterozygous to 1 susceptible to race 7; lines having all plants either immune from, or semi-resistant to, race 3 had all plants either immune from, or resistant to, race 7; lines segregating for immunity, semi-resistance, and susceptibility to race 3 segregated for immunity, resistance, and susceptibility to race 7; lines having all plants either immune from, or susceptible to, race 3 had all plants either immune from, or susceptible to, race 7.

These results are explained on the assumption that immunity from races 7 and 20 in Buda is conditioned by a pair of dominant factors allelic to the pair of dominant factors conditioning immunity from 18 races in J. W. S., Buda carrying in addition factors responsible for semi-resistance to race 3 and resistance to race 7, which are independent of, and hypostatic to, the immune factors. On this basis the genotype of Buda is expressed as $L^1L^1RR$ and that of J. W. S. $L^2L^2rr$. Both the $L^1$ and the $R$ factors appeared to be operative in conditioning resistance to races to which Buda was resistant. The factors $L^1L^1$ had little effect in races to which Buda was semi-resistant, moderately susceptible, or susceptible, and reductions in the degree of susceptibility appeared to be largely due to the $R$ factor. Neither the $L^1L^1$ nor the $RR$ factors had any appreciable effect on the seedling reaction to races 4, 8, 19, and 22, to which Buda is susceptible. J. W. S. $L^2L^2rr$, was susceptible to races 7 and 9, but $F_3$ plants of genotype $L^2L^2RR$ were resistant to race 7, and their reaction to race 9 varied from moderately susceptible to susceptible. All plants tested were susceptible to races 16 and 21, to which both parents are susceptible. The $R$ factor was incompletely dominant and, under favourable growing conditions, heterozygous $L^1L^1Rr$ or $L^2L^2Rr$ plants were distinctly less resistant to races producing intermediate infection types, e.g., races 3 and 7, than homozygous plants $L^1L^1RR$ or $L^2L^2RR$. It is suggested that the use of a line having the genotype $L^1L^1rr$, previously unknown, will be helpful in the identification of physiologic races of the flax rust differentiated by the semi-resistant reaction of Buda.

GREEN (D. E.). **Diseases of bearded Irises.**—*Iris Yearb., 1941*, pp. 73–76, 1941.

Brief, popular notes are given on the causes, symptoms, and control of the principal diseases of bearded iris in Britain, viz., rhizome or soft rot [*Erwinia carotovora*: *R.A.M.*, xix, p. 119], leaf spot, caused by '*Didymellina* (*Heterosporium*) *gracile*' [*D.* (?) *macrospora*: ibid., xviii, pp. 31, 599], grey mould basal rot, due to *Botrytis cinerea* or a fungus closely related to it, rust (*Puccinia iridis*), and scorch, the cause of which has not yet been ascertained.

LANGDON (R. F.). **Occurrence of ergot in Queensland, with special reference to Claviceps pusilla Cesati.**—*J. Aust. Inst. agric. Sci.*, vii, 2, pp. 85–87, 1941.

So far, 13 species of native grasses in south-eastern Queensland have been observed to be affected by ergot in the field, and two others have been found susceptible by artificial inoculation. The species

concerned are *Dichanthium sericeum, Bothriochloa decipiens, B. intermedia, B.* sp., *Cymbopogon refractus, Heteropogon contortus, Themeda australis, Sorghum leicladum, Ischaemum australe, Eriochloa pseudocrotricha, E. procera, E.* sp. *Digitaria longiflora, Brachiaria whiteana,* and *Capillipedium spicigerum.*

Sclerotia from *Dichanthium sericeum* collected in May, 1940, germinated in October of that year, the species being determined as *Claviceps pusilla* Cesati, described in 1861 from material collected in northern Italy on *Bothriochloa ischaemum.* This appears to be the first time that germination of the sclerotia has been observed in 80 years. It is proposed that the fungus should be known as the 'blue grass ergot'.

The conidia of *C. pusilla* from *D. sericeum* are hyaline, elliptical, or curved, and measure 10 to 15·5 by 5 to 7·5 $\mu$. Some of the curved ones are straight on one side and sharply curved on the other, with the result that they appear to be three-sided. Examination of the conidia from other affected species showed that they were all similar in size and shape to those from *D. sericeum.*

Powell (D.), Anderson (H. W.), & Kohn (R.). **The use of eradicant sprays for controlling Apple scab in Illinois, 1940 results.**—*Trans. Ill. hort. Soc.*, lxxiv, pp. 213–234, 5 figs., 1940. [Abs. in *Exp. Sta. Rec.*, lxxxv, 5, p. 635, 1941.]

In the writers' tests in Illinois in 1940 the initial apple scab [*Venturia inaequalis*] inoculum was reduced by 86 to 90 per cent. by the use of elgetol [*R.A.M.*, xx, p. 370], the most satisfactory ground coverage being secured with the 600 gals. per acre rate of spray at a dilution of 0·5 per cent. The treatment of dead foliage is regarded as a supplementary measure rather than as a substitute for ground spraying, and a reduction in the number of foliar applications where the latter method is practised is not recommended. The chief merit of elgetol lies in the assurance of superior scab control and the improbability of difficulties when seasonal conditions favour the disease or foliar sprays cannot be applied according to schedule.

Smock (R. M.) & Van Doren (A.). **Controlled-atmosphere storage of Apples.**—*Bull. Cornell agric. Exp. Sta.* 762, 45 pp., 16 figs., 4 diags., 1 graph, 1941.

Control of scald [*R.A.M.*, xx, pp. 68, 476] in stored McIntosh apples was obtained in an atmosphere of 5 per cent. carbon dioxide and 2 per cent. oxygen with 1/4 to 1/3 lb. of shredded oiled paper well mixed with each bushel of fruit. When higher concentrations of carbon dioxide are used and consequently the susceptibility to scald is increased, more paper is likely to be needed. The use of a washer in maintaining the atmosphere seemed to reduce scald somewhat, since the alkali dissolves some of the volatiles which cause the disorder. Excellent control of scald on the less susceptible varieties was also obtained with oiled-paper wraps. Although oiled wraps and oiled shredded paper increase the cost of packing considerably, have a drying effect on the atmosphere, and tend to absorb and retain odours from containers, their use is recommended as being still the only satisfactory means of controlling the disorder on

the less susceptible apple varieties. Oiled paper does not control scald on the highly susceptible varieties in controlled-atmosphere (= gas) storage.

SMITH (R. E.). **Transmission of diamond canker of the French Prune.**—*Phytopathology*, xxxi, 10, pp. 886–895, 3 figs., 1941.

A detailed account is given of a series of experiments carried out at the University of California, Berkeley, to determine the mode of transmission of diamond canker of Agen French prunes [*R.A.M.*, xii, p. 180]. When buds or scions were taken from affected trees, the rough, corky thickening of the bark, with diamond-shaped excrescences at the sites of pruning cuts or cortical fissures, characteristic of the trouble, rapidly developed in the resultant growth if bark lesions were present in the parts used for propagation. On the other hand, propagative material of normal aspect taken from the same or other diseased trees induced no sign of the disorder on the stocks on which it was grafted during the period of eight years covered by the tests. In a few instances, when normal and cankered scions were inserted on opposite sides of the same non-susceptible Pomaceous stock, e.g., almond, peach, apricot, or plum, the disease appeared in the growth from the healthy grafts. It is concluded that diamond canker of Agen prunes (none of the other varieties tested was susceptible) is caused by a localized virus presenting certain analogies with citrus psorosis [ibid., xviii, p. 671 *et passim*].

RAWLINS (T. E.) & THOMAS (H. E.). **The buckskin disease of Cherry and other stone fruits.**—*Phytopathology*, xxxi, 10, pp. 916–925, 2 figs., 1941.

Among the more striking differences in the symptoms of cherry trees suffering from buckskin disease in the Green and Napa Valleys of California [*R.A.M.*, xix, p. 484] are, in the former, the apparently normal flower buds, conical dull-surfaced fruits, early and mid-season foliage practically normal on Mazzard stocks, severely chlorotic on Mahaleb (*Prunus mahaleb*); and, in the latter, ragged flower buds, normal-shaped fruits without marked superficial dullness, the leaves of older trees small and pale green on both stocks, numerous on Mazzard and sparse on Mahaleb. These differences are suggestive of the existence of distinct strains of the virus, more direct evidence in support of which was obtained from a test in which diseased Napa scions were grafted on four healthy cherry trees on Mazzard stocks in Green Valley. The symptoms developing on the inoculated trees were typical of those occurring in the Napa Valley, whereas fruits in the same plot on trees grafted with local inoculum showed the characteristic Green Valley features. The principal symptoms of the disease on peach, known as X disease or yellow-red virosis in other States, have already been described [loc. cit., *et passim*]. Apricots display no external signs of buckskin, though the virus was recovered from or passed through Blenheim apricot growing on diseased peach by inarching a healthy peach seedling on the apricot.

The examination of transverse sections of diseased peach stems revealed degeneration of the phloem tissues, the affected cells, usually

situated midway between the phloem rays, staining red with phloroglycinol in 18 per cent. hydrochloric acid. The leaves of peaches under glass are apt to develop pronounced vein-swelling, accompanied by the formation of schizogenous cavities at the junction of the lamina and vein, hypertrophy and hyperplasia in the phloem rays, parenchyma, and bundle sheath, and the deposition of a brown or yellow substance in phloem ray and bundle sheath cells. The abscission of chlorotic or purple areas along the margin of the lamina is preceded by the solution of the intercellular substance in a narrow zone surrounding them, outside which wound gum is formed and suberization is ultimately effected.

In field and greenhouse graft inoculation experiments with the buckskin virus, Napoleon cherry on Mazzard stock and Orange Cling peach provided the best sources of inoculum of those so far tested. In the field the incubation period of the disease ranges from a few months to several years, while a period of two months is ordinarily required for the development of infection in the greenhouse. Positive results were obtained with inoculum from sweet cherry on seedling, Seller's Orange, and Elberta peaches, and English Morello on Mazzard; from *P. demissa* on cherry and peach; and from peach on sweet cherry, Morello seedlings, *P. mahaleb*, and peach, but the last-named is inferior as a source of inoculum to sweet cherry and *P. demissa*. The Shalil peach variety and *P. mira* also proved susceptible to buckskin, while the virus was also recovered, in at least one instance, from almond on which the symptoms are often so indefinite as to preclude certain diagnosis. Plum varieties have hitherto shown no symptoms of the disease, but attempts at the recovery of the virus are not yet concluded. In preliminary experiments *P. cerasifera*, *P. marianna*, *P. subcordata*, and a number of other species proved to be highly resistant or immune.

YARWOOD (C. E.). **Diurnal cycle of ascus maturation of Taphrina deformans.**—*Amer. J. Bot.*, xxviii, 5, pp. 355–357, 1 fig., 1 graph, 1941.

A study of the diurnal cycle of *Taphrina deformans* on peach trees in a natural environment in California was conducted by observing sections of infected leaves collected at different times of the day, by counting the spores caught on slides exposed periodically in infected trees, and by inducing spore discharge from diseased leaves collected at different hours. These three independent methods gave substantially identical results. The asci start to grow from the ascogenous cells in the evening, nuclear divisions occur at night, and spores mature the next day. Ascospores are naturally discharged most profusely in the evening, with a maximum discharge at about 8 p.m., i.e., several hours after morphological maturity has been reached. Ascospore discharge is stimulated by the vapours of formalin-acetic-alcohol acid fixative, but does not occur until after the spores are morphologically mature.

REYNEKE (J.). **The final ripening period in relation to woolliness of Peregrine Peaches.**—*Sci. Bull. Dep. Agric. S. Afr.* 228, 19 pp., 2 graphs, 1941. [Afrikaans summary.]

In further studies at the Western Province Fruit Research Station, Stellenbosch, 'woolliness' in Peregrine peaches [*R.A.M.*, xix, p. 286]

was shown to be a continuation of the temporarily juiceless condition through which the fruit normally passes prior to reaching table-ripe maturity. Peaches placed in cold storage at this stage in their development will retain the 'woolly' texture, the persistence of which is brought about by the action of the low temperature on the cell-wall hydrolysing enzymes. The temporary juiceless condition is caused by a rapid decline in firmness during the final stages of ripening on the tree, precluding the mechanical rupture of the cells, the rupture of which by means of freezing restored juiciness in 'woolly' fruit. It was ascertained that fruit picked in the 'A' stage, i.e., when firm and juicy, without flavour, the ground colour green with a slight blush, developed 46·7 to 68·4 per cent. 'woolliness' after a week at 45° F., compared with 0 to 4·2 per cent. (slight) for that gathered at stage 'B', soft and juiceless, with the ground colour beginning to disappear and the peach taste just perceptible. In accordance with these observations, it is recommended that fruit intended to reach cold storage 24 hours after picking should not be gathered until the conclusion of the juiceless stage, and further, that fruit arriving at the docks before attaining a minimum content of expressible juice of $\pm 30$ c.c. per 100 gm. tissue should not be allowed to enter cold storage. The same minimum appeared to be requisite for the prevention of internal breakdown [ibid., xvii, p. 470], which is most prevalent in fruit picked at the 'A' and 'C' (soft and juicy, table-ripe) stages.

Cochran (L. C.) & Hutchins (L. M.). **A severe ring-spot virosis on Peach.**—Abs. in *Phytopathology*, xxxi, 9, p. 860, 1941.

In May, 1940, J. H. Hale and Late Elberta orchard peach trees showed twig blight and severe die-back, the current season's growth exhibiting dark, sunken areas of varying dimensions from spots to large cankers, while scattered leaves bore rings, yellow spots, and chlorotic patterns. In May, 1941, none of the symptoms was present on trees affected in 1940. On 15th May, 1940, J. H. Hale nursery peaches were grafted with scions from the severely affected orchard trees, and within two months sunken areas had developed in the bark on the grafted trees and the twig terminals in a vertical line above the points of grafting were dying back. By the following October extensive twig girdling and splitting and furrowing of the trunk bark had begun, and in the next year the onset of growth was much retarded and the initial, abnormally pale green leaves bore similar patterns to those observed in the orchard in 1940; the later foliage, developing after the abscission of the mottled leaves about the middle of May, appeared normal. Nursery trees of Ne Plus Ultra almond, myrobalan plum [*Prunus divaricata*], Mahaleb and Mazzard cherries, graft-inoculated from the diseased orchard peaches, developed ring spots and chlorotic and necrotic patterns in the foliage. Other tests demonstrated the existence of a virus group in stone fruits in California capable of producing symptoms in peach similar to those described above.

Anderson (H. W.). **Red stele root rot of the Strawberry.**—*Trans. Ill. hort. Soc.*, lxxiv, pp. 383–393, 1940. [Abs. in *Exp. Sta. Rec.*, lxxxv, 5, p. 636, 1941.]

The symptoms of red stele [core] root rot of strawberries and the

life-history of its agent, *Phytophthora fragariae*, are described, and various possible methods of control, based on studies of the disease in Illinois, are indicated. So far no case of infection has been observed on the Aberdeen variety [*R.A.M.*, xx, p. 482], the resistance of which is transmitted to a high proportion of its progeny.

WORMALD (H.) & MONTGOMERY (H. B. S.). **Leaf blotch of Strawberries.** —*Gdnrs' Chron.*, 3rd Ser., cx, 2864, p. 180, 1 fig., 1941.

Early in August, 1941, strawberries at Trottiscliffe, Kent, developed leaf blotches bearing the pycnidia of *Phyllosticta grandimaculans* [*R.A.M.*, vii, p. 700]. The same disease was ascertained to have occurred at Westerham, Kent, in February, 1939, and in several other localities in the same county. The smallest spots showed a grey, nearly white, centre, with a purplish border, and some bore fructifications of *Ramularia tulasnei* [ibid., xii, p. 705], the conidial stage of *Mycosphaerella fragariae*. Larger spots on the same leaves were similar in appearance, but had pale, yellowish-brown centres; they ranged up to 2 in. in diameter, the bigger ones taking the form of irregular blotches. The larger blotches had a small, pale brown centre, then a broad brown zone bordered by a narrow, dark purplish ring. Beyond this, the leaf surface was occasionally yellowish, the discoloration merging into the green of the healthy part. Subsequently, leaves were noted on which most of the surface was affected, the leaflets being crumpled and distorted. The *P. grandimaculans* fructifications, which were usually present on the brown parts surrounding the pale central spot, though occasionally found on the centre itself, measured 140 to 285 $\mu$ in diameter, and were somewhat lenticular; in a damp atmosphere they exuded a pale, glistening globule consisting of cylindrical spores measuring 5·5 to 7 by 1·5 to 2 $\mu$, with rounded ends, and abstricted from conidiophores 12 to 15 $\mu$ long, lining the inner wall of the pycnidium. In distilled water at 18° C. they produced germ-tubes up to 30 $\mu$ long after 48 hours. Inoculations with the fungus have not yet been carried out. The disease appears to be much more destructive than the common leaf spot caused by *M. fragariae*. The suggestion is made that it should be referred to as strawberry leaf blotch.

WOOD (C. A.) & WHITEHEAD (T.). **Aphid transmission of Strawberry viruses.**—*Nature, Lond.*, cxlviii, 3759, pp. 597–598, 1941.

In tests at Bangor, North Wales, in 1940 and 1941 the virus of strawberry crinkle (*Fragaria* virus 2) [*R.A.M.*, xix, p. 717] was transmitted from Royal Sovereign strawberries to *Fragaria vesca* by *Pentatrichopus* [*Capitophorus*] *tetrarhodus* Walk., the resultant symptoms being indistinguishable from those produced by *P.* (*Capitophorus*) *fragariae*.

CHAMBERLAIN (G. C.). **A necrotic 'fern-leaf' mosaic of Raspberry.**—*Sci. Agric.*, xxii, 2, pp. 119–124, 2 figs., 1941.

In May, 1935, a single three-year-old Cuthbert raspberry stool in a plantation belonging to the Dominion Laboratory of Plant Pathology, St. Catherines, Ontario, showed symptoms suggestive of a new virus disease, which so far has not been recorded in commercial plantations.

Foliage mottling ranged from distinct yellow spotting and ring-spotting to extensive, coarse, well-defined pale green to yellow blotches; when extensive, it closely resembled the severe form of green mottle mosaic. Mottling became partially or entirely masked in midsummer, to reappear later. Necrotic spotting was extensive on the older basal leaves of newly infected canes, generally in association with the yellow spotting. Conspicuous cane and leaf stunting was present, and the bud development of fruiting canes was very irregular, some developing normally, others showing delayed foliation, and the remainder failing to grow. The berries from diseased canes were small, dry, seedy, and acid in taste.

In transmission tests, 122 patch grafts were made to young, healthy canes of different red and black varieties, with 90·1 per cent. successful transmission. Evidence was obtained that the disease is distinct from green mottle mosaic.

SIMMONDS (J. H.). **Latent infection in tropical fruits discussed in relation to the part played by species of Gloeosporium and Colletotrichum.**—*Proc. roy. Soc. Qd*, lii, 10, pp. 92–120, 6 pl., 1941.

In a study in Queensland of latent infection in tropical fruits mostly associated with species of *Gloeosporium* and *Colletotrichum*, it was shown that immature banana fruits inoculated in the field with *G. musarum* [*R.A.M.*, xix, p. 551] could remain in a latent state of infection for $5\frac{1}{4}$ months, after which period the fungus resumed activity to produce typical anthracnose lesions in the ripening fruit. Only a proportion of the original infections developed into spots on ripe fruit. Investigation into histological changes associated with latent infections of banana, papaw [see next page], and mango [ibid., xx, p. 27] fruits showed that a fine infection thread penetrates the cuticle direct from the appressorium and forms a hyphal structure adjacent to the cellulose wall of the epidermal cell. This subcuticular hypha is considered to be the form in which the fungus survives its period of latency. It is believed that the main function of the appressorium is to provide a firmly attached reservoir from which the infection thread may be produced. The appressorium is more resistant than the spore to certain chemicals and for that reason may be unaffected by some sprays. It is thought to be probably homologous with a chlamydospore, but in consideration of its function the use of the name appressorium is preferred. As an explanation of the absence of active parasitism in the green fruit, it is suggested that the outer cellulose layer of the epidermal wall acts as a barrier that the parasite is unable to overcome owing to the chemical nature of the wall or possibly the constitution of the cell sap at that time, and is, therefore, forced to remain dormant. Later, owing to the withdrawal of toxic substances or to an increase in enzyme action resulting from better nutrition and growth or alterations in the constitution of the cell sap, intercellular development becomes possible and rapid growth of the parasite follows.

SILBERSCHMIDT (K.) & NOBREGA (N. R.). **Sôbre uma doença de virus de Bananeira.** [On a Banana virus disease.]—*Biológico*, vii, 8, pp. 216–219, 2 pl., 1941. [English summary.]

Bananas of the Gros Michel, Prata [Silver], Ouro [Gold], S. Tomé,

Nanica [Dwarf], Nanicão, Java, and Maranhão varieties at Campinas and Capital, São Paulo, Brazil, are affected by a mottling of the foliage in the form of alternate dark and light, unbroken or discontinuous stripes, starting from the midrib and extending to the margins; in some cases necrosis ensues. The leaves may present a wavy appearance, and in severe cases the lamina is much reduced. The disease may or may not be fatal, and it is noteworthy that both perfectly sound and infected plants may arise from the same rhizome.

Attempts to transmit the disorder from infected to healthy plants by mechanical means or planting diseased and sound bananas in the same container gave negative results, but the typical mosaic symptoms developed in one plant inoculated with the aid of the aphid *Pentalonia nigronervosa*, and infection was further conveyed through the juice of diseased bananas to White Burley tobacco, *N[icotiana] rustica*, and from these back to White Burley and also to *N. glutinosa*, *Datura stramonium*, and *Petunia* sp. From the symptoms induced by the banana mosaic in these experiments, especially on *N. glutinosa* and *P.* sp., it is tentatively referred to the *Cucumis* virus 1 group.

Symptoms resembling those of the diseased bananas were observed in a field of Java bananas on *Commelina nudiflora* [cf. *R.A.M.*, xiv, p. 615], *Stachys arvensis*, *Ageratum conyzoides*, *Amaranthus retroflexus*, and *Richardsonia brasiliensis*, inoculations with the expressed juice of all of which gave positive results on White Burley and Geudertheim tobacco, *N. rustica*, *N. glutinosa*, *D. stramonium* and *P.* sp.

Gonçalves-Silva (S.). **Doenças do Mamoeiro.** [Papaw diseases.]—*Biológico*, vii, 8, pp. 220–225, 1941.

The writer describes the symptoms and recommends measures for the control of the following diseases affecting papaws in São Paulo, Brazil: leaf spot (*Asperisporium caricae*), anthracnose (*Colletotrichum gloeosporioides*), powdery mildew (*Oidium caricae*) [*R.A.M.*, xx, p. 587], black rot (*Mycosphaerella caricae*) [ibid., xviii, p. 505], mosaic [ibid., xix, p. 642; xx, p. 565], and leaf spots caused by species of *Cercospora*, *Ascochyta*, and *Phyllosticta*.

Hedden (O. K.) & Merrill (R. M.). **Experiments in the use of vapour-spray equipment.**—*Circ. U.S. Dep. Agric.* 598, 20 pp., 5 figs., 2 diags., 1940. [Received November 1941.]

In comparative field trials carried out in the United States it was found that the water required for spraying fruit trees with the ordinary hydraulic sprayer in common use can be reduced from 1/3 to 1/2 by the use of a vapour-spray equipment [*R.A.M.*, xviii, p. 383] operated by an oil-burner. This economy was, however, offset by the cost of operating an oil-burner of suitable size. Some materials, such as phenothiazine, free nicotines, and Bordeaux proved entirely unsuitable for use in vapour-spray equipment, while free nicotines withstood the heat somewhat better, and sulphurs generally improved in fungicidal action and sticking qualities. It is believed, however, that under certain conditions some polysulphides injurious to foliage may be produced by incomplete chemical reactions of lime and sulphur while heated in the spray hose. Control of apple scab [*Venturia inaequalis*], cherry leaf

spot [*Coccomyces hiemalis*], and peach leaf curl [*Taphrina deformans*] with vapour-sprayed liquid lime-sulphur or inexpensive dusting sulphur made wettable was, in practically all cases, equal or superior to that obtained with a hydraulic sprayer. In addition, sprays irritating to the skin caused considerably less discomfort. All insoluble copper compounds tested were injurious to foliage when applied with the vapour-spray apparatus. The spray produced by it is finely divided, and has, therefore, the advantage of evaporating rapidly in damp weather. Under windy conditions, on the other hand, it does not carry quite as well as that produced by the hydraulic spray. It is concluded from these results that the use of vapour-spray apparatus for applying any of the materials used in spray schedules is apparently limited to fixed nicotines and sulphur compounds.

**British Standard Specifications (A.R.P. series) [BS/ARP 56] for rot-proofing canvas, yarn and cordage, [BS/ARP 57] for the rot-proofed Jute, Hessian sandbags, [BS/ARP 58] for rot- and water-proofing of Jute canvas.**—12 pp., British Standards Institution, 28 Victoria Street, London, S.W. 1. August, 1941. 2*d.* (post free 4*d.*) each.

The British Standard Specifications (A.R.P. series) BS/ARP 56, 57, and 58 for the rot-proofing treatment of textiles [*R.A.M.*, xx, p. 168] were prepared at the request of the Ministry of Home Security. (1) BS/ARP 56, relating to the protection of canvas, yarn, and cordage, deals with the application of (*a*) copper salts, (*b*) zinc salts, and (*c*) creosote-coal tar distillate. (2) BS/ARP 57 covers the preservation of jute and hessian fabrics (sandbags) by means of copper salts, copper-creosote, or creosote. (3) BS/ARP 58 specifies that jute canvas fabrics, before water-proofing, shall be rot-proofed either by the application of copper naphthenate or another approved medium, or by the use of cuprammonium/bitumen.

Chace (W. G.). **The storage of mold cultures.**—*Amer. Dyest. Rep.*, xxix, 17, pp. 429–430, 1940.

At the Lowell Textile Institute *Chaetomium globosum* [*R.A.M.*, xx, p. 587], *Aspergillus niger*, *A. fumigatus*, *A. glaucus*, and *A. wentii* (all from textiles except the first-named) were maintained in vigorous condition for three years by culturing on long slants of Czapek's agar in 8 by 1 in. tubes and allowing these cultures to attain a heavily sporulating condition in a 30° C. high humidity incubator, before transference to a large desiccator in which drying rapidly ensued.

Loos (C. A.). **A virus disease of Emilia scabra.**—*Trop. Agriculturist.* xcvii, 1, pp. 18–21, 1 pl., 1941.

*Emilia scabra* (a common weed), growing on marsh land in the Talawakelle district of Ceylon was observed, rather more than a year ago, to show a disease, characterized chiefly by yellow veinbanding, which has since become much more prevalent. No organism appeared to be associated with the condition, which was successfully transmitted to healthy *E. scabra* plants by grafting, and is regarded as being, probably, of virus origin.

Smith (K. M.) & MacClement (W. D.). **Further studies on the ultrafiltration of plant viruses.**—*Parasitology*, xxxiii, 3, pp. 320–330, 2 graphs, 3 diags., 1941.

Ultrafiltration studies [which are described] showed that *Lycopersicum virus* 4 (tomato bushy stunt), *Nicotiana virus* 11 (tobacco necrosis), and *N. virus* 12 (tobacco ring spot) all filtered in a consistent manner and appeared to have approximately spherical particles [*R.A.M.*, xix, p. 731]. In each case the filtration end-point was 40 mμ, from which a particle diameter of 13 to 20 mμ is calculated. The filtration curve of tobacco necrosis virus showed, however, a 'bench' or 'shelf', which suggests either a polydisperse system or some disymmetry in particle shape.

Difficulty was experienced in filtering *Nicotiana virus* 1 (tobacco mosaic) and its strains. A value of 13 to 20 mμ was found for the particle diameter of the type virus, but the evidence indicated that the infective units may vary considerably in length. With *Solanum virus* 1 (potato virus X), another rod-shaped virus which was also difficult to filter, the end-point was 100 mμ, with particle diameter calculated at 33 to 50 mμ.

McWhorter (F. P.). **Plant-virus differentiation by trypan-blue reactions within infected tissue.**—*Stain Tech.*, xvi, 4, pp. 143–148, 1 pl., 1 fig., 1941.

Trypan blue (0·5 or 0·05 per cent.) has been found effective in tests at the Oregon Agricultural Experiment Station for the demonstration of the presence of certain viruses, e.g., tobacco mosaic, bean [*Phaseolus*] virus 2, and tulip virus 1, in diseased tissues, the amorphous and crystalline inclusions ('viroplasts') constituting cytological evidence of infections of this type [*R.A.M.*, xx, p. 603]. Phloxine (0·5 per cent.) has been found useful for the pink or purplish staining of inclusions which do not absorb trypan blue. The reagents are made up in physiological salt solution (0·85 per cent. aqueous sodium chloride), and used with a suitable detergent, e.g., 1 per cent. O.T. 100 (vatsol).

White (D. P.). **Prairie soil as a medium for tree growth.**—*Ecology*, xxii, 4, 398–407, 6 figs., 1 diag., 1941.

The outcome of greenhouse experiments at the Soils Department, University of Wisconsin, definitely showed the early development of both conifers and hardwoods to be adversely affected by some inherent deficiency of the prairie soil samples collected from the southern part of the State. Chemical analyses failed to reveal sufficient grounds for the poor growth of the trees, the response of which to fertilizer treatments was likewise inadequate. In a comparative test initiated in the autumn of 1939 red and white pine (*Pinus resinosa* and *P. strobus*) seedlings grown from surface-sterilized seeds in virgin Carrington silt loam prairie soil formed sparse secondary roots with abundant root hairs and a few mycelial strands, but no mycorrhizal mantle, whereas seedlings of the same two species raised on a similar soil with the addition of 10 per cent. humus top soil produced vigorous laterals with profuse mycorrhizal growth on the secondary roots, besides making twice as much top growth as those in the untreated soil. The inocula-

tion of a sterile medium in Erlenmeyer flasks, each containing two *P. resinosa* seeds, with pure maize meal-sand cultures of the mycorrhizal fungus on the lines advocated by Melin [*R.A.M.*, ii, p. 77] resulted in improved growth both of the root systems and crowns [cf. ibid., xviii, p. 267]. It is suggested that mycorrhiza exert a specific growth-promoting effect upon forest seedlings, the absence of this stimulus being a major factor in the poor growth of trees on mycorrhiza-free prairie soils.

GRIEVE (B. J.). **Studies in the physiology of host-parasite relations.**—*Proc. roy. Soc. Vict.*, N.S., liii, 2, pp. 323–341, 1 pl., 2 figs., 1941.

In further studies in Melbourne on the development of adventitious roots in tomato plants infected by *Bacterium solanacearum* [*R.A.M.*, xviii, p. 789] it was found that such roots frequently developed ahead of advancing columns of bacteria in the vessels and continued developing to the stage where the root becomes visible as a nodule at the surface of the stem, even though the vessels nearest the incipient root became gradually blocked. Some experimental evidence pointed to the possibility that where the invading bacteria are present in large numbers, sufficient to block some vessels, the blocking effect may be an important factor in root formation.

Ether extractions gave no significant difference in the growth substance content of healthy and invaded stem parts, but the close parallel between the formation of adventitious roots in healthy plants by the application of $\beta$-indole-acetic acid and in infected plants indicated that growth substance was associated with the formation of these roots. Whether the pathogen or the host produces the growth substance is a matter of opinion, but the author considers that the evidence available indicates that it is produced by the host cells as the result of local stimulation by the bacteria. Comparable inoculations with *Aplanobacter michiganense* and *Bact. tumefaciens*, both reported to produce a growth substance in culture, showed that the former gave variable results while the latter induced fewer and less well-distributed roots than *Bact. solanacearum*.

SAKSENA (R. K.). **Thiamin and growth of some species of Pythium.**—*Proc. Indian Acad. Sci.*, xiv, 2, pp. 141–148, 1 pl., 1941.

In the writer's experiments at the University of Allahabad *Pythium arrhenomanes*, *P. deliense* [*R.A.M.*, xv, p. 244], *P. graminicola*, *P. hyphalosticton*, and *P. mamillatum* [ibid., xv, p. 109] were found to be capable of unlimited growth on a nutrient solution consisting of mineral salts and pure dextrose and containing no appreciable amounts of thiamin or its intermediates. The fungi were shown to be capable of synthesizing their own growth-promoting substance from the elementary ingredients of the nutrient solution, and did not perceptibly respond to the addition of thiamin B [ibid., xx, p. 591].

WAKSMAN (S. A.). **Antagonistic relations of microörganisms.**—*Bact. Rev.*, v, 3, pp. 231–293, 1941.

The author summarizes and critically discusses the literature on various aspects of the antagonistic inter-relationships of various groups

of micro-organisms, including human, animal, and plant pathogens; most of the contributions concerned with the last-named have been noticed from time to time in this *Review*. The bibliography comprises 373 titles.

TEAKLE (L. J. H.), MORGAN (E. T.), & TURTON (A. G.). **Experiments with micro-elements for the growth of crops in Western Australia. III. Experiments with Potatoes, vegetables, and other crops in the Albany District.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xviii, 2, pp. 96–125, 6 figs., 1941.

In further experiments carried out in Western Australia to determine the response of different crops to micro-elements used in addition to the ordinary basal fertilizers [see above, p. 68], tests were made with Delaware potatoes on summer land at Grasmere, Many Peaks, Little Grove, and Lake Saidie. The last-named is an area acutely deficient in copper, Little Grove is acutely deficient in manganese and copper, Grasmere has produced excellent crops of potatoes nearly every year for 40 years without special fertilizer treatments, and Many Peaks is virgin peat land. A factorial design was used in four instances, and a randomized block for collateral purposes. Copper sulphate, manganese sulphate, and zinc sulphate were applied, the first two each at 0, 5, 10, and 20 lb. per acre, the last-named at 0, 2½, 5, and 10 lb. per acre. To cover all possible combinations, 64 different treatments were given, and those being triplicated, each experiment involved 192 separate plots. The crops planted included potatoes, tomatoes, peas, maize, swedes, and onions.

At Grasmere and Many Peaks no response in yield of potatoes was obtained from any micro-element or combination of elements. On the neutral, sandy, swamp soils of Lake Saidie and acidic bottlebrush [*Callistemon*] country potatoes, tomatoes, and maize gave excellent response to dressings of copper sulphate at 5 to 10 lb. per acre or more. No further improvement followed the application of other micro-elements. On the marly soils of Little Grove copper-containing fertilizers gave satisfactory yields of excellent tomatoes, but the addition of manganese was without any definite effect. With peas and swedes copper was also of the first importance, but further considerable improvement in yield resulted when manganese was used as well as copper. In the absence of copper, peas produced small, abortive pods or large pods containing tiny, abortive seeds. Potatoes failed to grow normally without manganese in the fertilizer mixture, but with manganese good yields of excellent tubers were obtained. The addition of copper further increased the yield, though copper without manganese was ineffective. It appears that in this district a soil dressing of 10 lb. of manganese sulphate plus 5 lb. of copper sulphate per acre should be used for potatoes. The use of zinc hastened the maturity of peas and swedes, but did not increase the yield of these crops.

It is concluded that certain soil types in the Albany district require the use of copper-containing fertilizers (5 to 10 lb. copper sulphate per acre) for the satisfactory growth of various crops, including potatoes, tomatoes, and maize. The best response is obtained from land that has deteriorated under previous crops, but a substantial effect is

observed on new land. A small dressing of copper sulphate may be advantageous in subsequent years. Certain marly soils require both copper and manganese. On these soils copper was of the first importance for tomatoes, and manganese for potatoes.

In one property at Lake Saidie all the potato plots receiving copper carried vigorous, thrifty-looking plants which withstood the dry summer conditions well, while the controls, given potato manure only, were dark green, stunted, and adversely affected by the summer weather. When the crop was dug, the control plot gave a low yield of misshapen tubers affected by a stem-end breakdown in which the flesh became of a soft, jelly-like consistency referred to as 'jelly-end rot'. Excellent yields were obtained from the copper-treated plots, but the quality was only fair.

When tomatoes were grown at Lake Saidie in soil treated with copper early growth was good, foliage normal, and fruiting satisfactory. The plants that received no copper made inferior growth, appeared unthrifty, and, in some cases, died out. The small amount of fruit they produced was of poor quality, the leaves were small and stiff, and the upper leaves rolled upwards, with the midrib as axis.

With maize at Torbay optimum results were given by copper sulphate applications of 10 lb. per acre. Growth was almost normal in the absence of copper sulphate on the sites of old ash beds, but on other parts of the untreated plots the maize did not grow beyond the seedling stage, developed pale yellow tipping of the leaves, poor roots, and weak stems, and finally collapsed in a rotting mass on the ground. Normal growth resulted where copper sulphate was applied.

Folsom (D.). **Results of testing some laboratory methods for possible use in the detection of virus diseases in Potato tubers.**—*Bull. Me agric. Exp. Sta.* 407, pp. 83–104, 1941.

The author describes 15 different laboratory methods of testing potato tubers for virus diseases, with regard to skin toughness, specific gravity, freezing injury, refractive index, copper-contact discoloration, and other reactions. Trials were carried out in Maine on the variety Green Mountain. In about 50 tests an average difference in measured characteristics was found to exist correlated with chronic infection (here meant as infection entering the parent plants through the seed pieces), but in about 90 tests no average difference was detected. Recent infection was correlated with an average difference in three tests, but not in 35 others. Average differences were more commonly observed with leaf roll and spindle tuber than with mild or rugose mosaics.

Nobrega (N. R.) & Silberschmidt (K.). **Estudos sôbre o estado sanitário de algumas variedades de Batatinhas peruanas.** [Studies on the sanitary condition of some varieties of Peruvian potatoes.]—*Biológico*, vii, 9, pp. 243–248, 2 pl., 1941. [English summary.]

The plants arising from the tubers of ten potato varieties collected in Peruvian native markets in 1940–1 and grown in São Paulo, Brazil, exhibited no symptoms of virus diseases, but the results of sap inoculation experiments from such plants on White Burley tobacco, *Nicotiana*

*glutinosa*, and *Datura stramonium* showed that four of the varieties under observation actually harboured viruses, that from the Serrana negra variety presenting analogies with the Y virus, while that in Mamada, Rosa, and Huanafana was apparently related to the X group [*R.A.M.*, xviii, p. 411].

Söding (H.) & Funke (Hildegard). **Ueber den Wuchsstoffhaushalt abbaukranker Kartoffeln.** [On the auxin economy of degenerate Potatoes.]—*Phytopath. Z.*, xiii, 4, pp. 351–368, 1 diag., 4 graphs, 1941.

In investigations on potato degeneration of virus origin at the Dresden Technical College the writers developed the following method of determining the plasticity of potato stems. Pieces of stem 10 cm. in length were weighed down for 30 seconds by a 5 gm. rider at a distance of 1·25 cm. from the tip, on the removal of which the stem sprang back, without, however, regaining its original position. The degree of inclination still persisting 15 minutes after release was measured with the aid of a horizontal microscope, the mean plasticity being computed from the values obtained for the upper and under sides of the stem, which may be widely divergent. By this means Stärkereiche [starchy] and Parnassia stems, the former suffering from leaf roll and the latter from a combination of mosaic and leaf roll, were found to be substantially less 'plastic' than that of healthy ones (40 as compared with 66 and 29 as against 74, respectively), whereas in the case of mosaic-infected Direktor Johanssen and especially Industrie the differences were inconsiderable. The diseased petioles of Parnassia, Stärkereiche, and Industrie were experimentally shown to respond less actively to treatment with dilute solutions of heteroauxin than healthy ones, thereby confirming the results obtained in previous trials by Hilde Lucas [*R.A.M.*, xix, p. 298]. The auxin content of half tubers of the above-mentioned varieties, with the addition of Odenwälder Blaue and Frühgold, was found to be consistently lower in diseased than in healthy material, the results being particularly clear-cut in regard to leaf roll.

Ark (P. A.). **The use of iodine in the control of Potato ring rot and scab.**—*Phytopathology*, xxxi, 10, pp. 954–956, 1941.

In experiments in California the immersion of cut potato seed pieces for three minutes in a 0·5 per cent. solution of iodine in 1 per cent. potassium iodide caused considerable injury and reduction in germination, besides failing to control ring rot (*Phytomonas sepedonica*) [*Bacterium sepedonicum*], which was, however, largely eliminated by dipping the cutting knife in 1 per cent. iodine [*R.A.M.*, xx, p. 275] before cutting each tuber. In a field test on the White Rose variety the incidence of ring rot following the use of a disinfected knife amounted to 5·3 per cent. of 225 hills, and there was a stand of 92 per cent., whereas failure to sterilize the knife resulted in 78·7 per cent. infection of 169 hills, with a reduction of the stand to 71 per cent. An effective formula for knife disinfection consists of 38 gm. iodine, 76 gm. potassium iodide, 1 pt. glycerine, and 2 gals. water. The knife should be wiped on a cloth before immersion to ensure the removal of the bacterial masses from the slime and tissue debris, which might otherwise protect them from contact with the antiseptic.

The scab [*Actinomyces scabies*] organism within the lesions was killed by five minutes' immersion of the tubers in 1 per cent. iodine, and in a field test on heavily infected whole Russet Rural seed potatoes only 2·5 per cent. of the tubers raised from the treated seed developed scab, compared with 47 per cent. in the control rows. In another test 8 per cent. of the tubers given one minute's treatment contracted infection, as against 69 per cent. of the controls. The five-minute treatment of whole tubers caused no decline in germination even after five months' storage.

The sclerotia of *Rhizoctonia* [*Corticium*] *solani* were not eliminated from Russet Rural tubers by the iodine method of disinfection.

GLICK (D. P.). **Results of attempted eradication of bacterial ring rot from Potatoes.**—*Amer. Potato J.*, xviii, 5, pp. 140–143, 1941.

Using the microscopic method already described [*R.A.M.*, xix, p. 360], the writers in 1940 successfully eliminated bacterial ring rot (*Phytomonas sepedonica*) [*Bacterium sepedonicum*] from selected lots of nine out of ten potato varieties at the Colorado Agricultural Experiment Station, the exception being Katahdin, in which 9 out of 4,000 hills were infected.

RUEHLE (G. D.). **A Xylaria tuber rot of Potato.**—*Phytopathology*, xxxi, 10, pp. 936–939, 2 figs., 1941.

Since 1936–7 potato tubers grown during the winter in the calcareous marl soils of southern Florida have been attacked by a species of *Xylaria* causing circular, sunken, sharply defined lesions, with pale tan centres shading to light brown at the margins, with the conspicuous black, simple or branched rhizomorphs, up to 3 mm. in thickness, adhering firmly to the surface of the tubers and acting as foci of infection. The fungus is characterized on the wood of willow [*Salix*], its normal host, by upright, solitary or pluricespitose, simple or rarely branched stromata, 0·5 to 8 cm. or more in length, sometimes furnished with stipes several cm. long, typically cream- to tan-coloured at the apiculate tips, shading to olivaceous-brown and then to black towards the base, where the surface is densely villose from the numerous dark hyphae arising from the surface, this character being lost as maturity approaches and replaced by undulations and prominent striations, presenting the aspect of fissured bark. Subhyaline to yellowish, continuous, fusiform to elliptical conidia, 6 to 7 by 2 to 3 $\mu$, are copiously produced from the surface just below the tips. The cylindrical, hyaline, stipitate asci, 135 to 170 by 8 to 11 $\mu$, each contain eight uniseriate, inequilaterally elliptical, brown, continuous or indistinctly septate spores with rounded ends, 16 to 25 by 4·5 to 7 (average 19·5 by 6) $\mu$. The fungus, which E. West has tentatively identified with *X. apiculata*, makes luxuriant growth on potato dextrose agar. The inoculation of wounded potato tubers with cultures of the fungus resulted in a very slow rot similar to that observed in nature. Besides the willows growing in close proximity to the diseased potato crops, other kinds of rotten wood have also been found to harbour the fungus in various parts of the State.

Kawamura (E.). **Reaction of certain species of the genus Oryza to the infection of Piricularia oryzae.**—*Bult. sci. Fak. terk. Kyuŝu Univ.*, ix, 2, pp. 157–166, 1 pl., 1940. [Japanese, with English summary.]

The results of inoculation experiments with *Piricularia oryzae*, the agent of rice blast, on four species of *Oryza*, two with 24 and two with 48 chromosomes, showed that the former (*O. sativa* and *O. cubensis*) are susceptible, and the latter (*O. latifolia* and *O. minuta*) highly resistant. In the leaves of all the species infection was established by direct penetration of the hypha from an appressorium through the epidermal wall [*R.A.M.*, xix, p. 673], and the motor cell was most easily infected by this method. In *O. sativa* and *O. cubensis* there were no perceptible changes in the epidermal or motor cells, and the necrotic tissues were surrounded by wide venenate zones in which the chloroplasts were discoloured and disorganized. In *O. minuta* the necrotic cells were few and the venenate zones absent; in *O. latifolia* resinous deposits were accumulated in the intercellular spaces of the diseased tissues, in which no conidia developed even under favourable conditions. The $F_1$ progeny of *O. sativa* × *O. minuta* was equally resistant with the latter parent.

Agati (J. A.), Sison (P. L.), & Abalos (R.). **A progress report on the Rice maladies recently observed in central Luzon with special reference to the 'stunt or dwarf' disease: 1.**—*Philipp. J. Agric.*, xii, 2, pp. 197–210, 7 pl. (2 col.), 1941.

Three distinct sets of pathological symptoms were found to be present on the rice crops of central Luzon, Philippine Islands, inspected by the writers in 1940, viz., (1) stunted growth and general yellowing of the entire plant, common among late-sown stands in dry, sandy sites; (2) stunting and gradual desiccation and shrivelling of the leaves from the tip downwards, starting from the lower leaves and proceeding upwards, this form of the trouble usually occurring in localized patches; and (3) a yellowish-white or white, linear streaking of the upper young leaves. The individual stripes originate as dots or specks along the veins of an unfurled leaf but coalesce to form white, broken or continuous streaks, up to 1 mm. in width, in all except the oldest leaves. The affected leaves are short, narrow, and stiff, and the entire plant severely stunted, with correspondingly short internodes. Tillers are produced in abundance, but they are also stunted and streaked. This habit of growth results in a fan-like, crowded, or rosette-shaped crown. The mature leaves of diseased plants tend to thicken and develop a dark green coloration. Panicle formation is scanty or absent. The varieties affected by this relatively uncommon form of stunting or dwarfing, which appears to be new to the Philippines and similar to, or identical with, the Japanese 'dwarf' or 'stunt' disease [*R.A.M.*, xviii, p. 613], include Macan Bino, Dinalaga, Apostol, Azucena, Macan Santa Rosa, Tabuhan, strains 1 and 1*a* of Guinangang, and strains 1 to 4 of the Antipolo-Guinangang cross, undergoing field tests at the Maligaya Rice Experiment Station.

Form (1) of the disease complex under observation was found to be predominantly associated with poor, dry soil conditions, while (2) and

(3) were experimentally shown to be caused and transmitted, respectively, by the leafhopper *Nephotettix bipunctatus*.

MURRAY (R. K. S.). **Report of the Botanist and Mycologist for 1940.**—*Rep. Rubb. Res. Bd, Ceylon, 1940*, pp. 46–68, 1941.

In this report [cf. *R.A.M.*, xix, p. 673] the author states that the incidence of *Oidium* leaf disease [*O. heveae*] of *Hevea* rubber in Ceylon during the refoliation season of 1940 was exceptionally light in most areas, except at the highest altitudes. This was the result of almost unbroken hot, dry weather early in the year. In 1939, the corresponding period was also a dry one, but the minimum temperatures were then very low. This difference in temperature accounts for the fact that *O. heveae* was much more active, and caused more defoliation, in 1939 than in 1940. Observations were pursued on trees marked as possibly resistant, but the results obtained were negative, though the search for resistant trees is being pursued. A piece of land was secured at an elevation of some 1,500 feet, for the establishment of a large 'museum' collection of possibly resistant clones.

Root disease, chiefly due to *Fomes lignosus*, continues to cause trouble, necessitating expensive control measures in replanted clearings. The actual loss of plants seldom exceeds 1 per cent. of the total stand, and if the correct treatment (complete removal of the source of infection) is applied directly each fresh focus of infection is discovered, incidence markedly decreases in the third or fourth year after planting. Thus, the problem consists in reducing expenditure on control to a minimum, rather than in preventing excessive loss of plants. Several estates have made periodical inspections of the root systems of individual plants in order that sources of infection may be revealed and eliminated as soon as possible, but there was no evidence that the treatment paid for itself by reducing subsequent losses.

Several cases of a diseased condition just above the graft union of plants budded about 18 months previously were observed in replanted clearings. In advanced cases the bark was dead all round the stem for a distance of two or three inches above the union, but showed no external lesion. The affected plants showed distress in the foliage. No organism was associated with the condition, which may possibly be due to excessively moist conditions, though the damage may not become evident until dry weather later.

Many young buddings developed sun scorch of the union during hot, dry weather early in the year. In many cases, the damage was extensive owing to invasion by *Diplodia* [ibid., xii, p. 591], some estates losing hundreds of plants; unhealed unions should be shaded on the south and west sides.

BEWLEY (W. F.). **Practical soil sterilization with special reference to glasshouse crops.**—*Bull. Minist. Agric., Lond.*, 22, iv+28 pp., 9 figs., 5 diags., 1941. 1*s*. 0*d*.

This is a reprint of the third edition of the bulletin with the same title originally published in 1931 [*R.A.M.*, x, p. 609], introducing slight amendments into the section on the 'Hoddesdon' system of steam sterilization to bring it up to date.

Wiehe (P. O.). **La morve rouge de la Canne à Sucre.** [Red rot of Sugar-Cane.]—*Rev. agric. Maurice*, xx, 4, pp. 198–202, 2 graphs, 1941.

Red rot (*Colletotrichum falcatum*) is stated to be one of the three principal sugar-cane diseases of Mauritius, the other two being gummosis [*Xanthomonas vasculorum*] and leaf scald [*Bacterium albilineans*]. On account of red rot the cultivation of such varieties as Bambou, Bois Rouge, Bellouguet, and DK/74 had long ago to be abandoned, while more recently the prolific and otherwise desirable M73/31 and Selangore Seedling have suffered the same fate. Discussing the combined influence of the periodicity of host growth and seasonal conditions on the development of the fungus, with special reference to the important industrial variety M134/32, the writer states that he observed up to 45 per cent. infection among one-year-old canes planted between September and mid-February, whereas those planted from April to July were quite free from rot.

Fawcett (G. L.). **El 'carbón' o 'tizón' de la Caña de Azúcar.** ['Smut' or 'blight' of Sugar-Cane.]—*Circ. Estac. exp. agríc. Tucumán* 100, 2 pp., 1 fig., 1941.

This is a popular note on the recent detection in the P.O.J. 36 sugar-cane plantations of Tucumán, Argentine Republic, of smut (*Ustilago sacchari*) [*U. scitaminea*: *R.A.M.*, xxi, p. 5]. Control should be based on the elimination of diseased material, either by roguing where only a few plants are infected, or by rotation with lucerne, maize, or some other non-susceptible crop in severe cases, while seed for new fields should be procured from healthy plantations.

Abreu (M. R.). **Results of a campaign against mosaic disease at Central Preston (Cuba).**—Communicated. [Abs. in *Sugar*, xxxvi, 11, p. 42, 1941.]

Since 1925, the mosaic-susceptible Cristalina sugar-cane variety, planted in Cuba [*R.A.M.*, xi, pp. 327, 603] over areas ranging from 9,500 to 16,000 acres, has been systematically rogued, with the result that the disease has practically disappeared from the Central Preston district, the number of stools per acre eradicated in 1940 being only 0·05 as compared with 12·76 in 1925. New plantings have consistently been made from carefully selected seed cane, which is also used for the refilling of gaps in ratoon crops.

Bruner (S. C.). **The diseases of Sugar-Cane.**—*Proc. As. Tec. Azúc. Cuba*, xiv, pp. 69–104, 1940. [Abs. in *Sugar*, xxxvi, 11, pp. 42–43, 1941.]

Mosaic is the most serious sugar-cane disease in Cuba, but it may be effectively combated by the use of resistant varieties, such as P.O.J. 2878, while even the old Cristalina, though susceptible, gives a satisfactory performance when healthy seed is planted on rich land [see preceding abstract]. P.O.J. 2878 and F.C. 916 are likewise resistant to eye spot [*Helminthosporium sacchari*: *R.A.M.*, xiii, p. 12], while the former and P.O.J. 2825 further withstand the very prevalent ring spot fungus [*Leptosphaeria sacchari*], which causes heavy damage to Crista-

lina. Brown stripe [*Cochliobolus stenospilus*: ibid., xx, p. 425] sometimes attacks P.O.J. 2878 severely, but is otherwise of little importance, and brown spot [*Cercospora longipes*] is injurious only to Co. 281. Certain Cuban and Puerto Rican canes have sustained extensive damage from target blotch [*H.* sp.], to which the standard varieties, however, are highly resistant. Other diseases of minor importance include pokkah-boeng [*Gibberella fujikuroi*], twisted top [ibid., xii, p. 328], rind disease [*Pleocyta sacchari*: ibid., vi, p. 509], root disease [associated with a complex of adverse growth factors: ibid., xi, p. 327], and red stripe [*Pseudomonas rubrilineans*].

PETRAK (F.) & ESFANDIARI (E.). **Beiträge zur Kenntnis der iranischen Pilzflora.** [Contributions to the knowledge of the Iranian fungus flora.]—*Ann. mycol., Berl.*, xxxix, 2–3, pp. 204–228, 1941.

The following are among the items included in this critically annotated list of 136 Iranian fungi, of which eight are new to science: *Peronospora arborescens* on opium poppy [*R.A.M.*, xviii, p. 140], *Kuehneola* [*Cerotelium*] *fici* on figs [ibid., xx, p. 136], *Puccinia graminis* on barberry (*Berberis integerrima*), *P. pruni-persicae* on peach [ibid., xv, pp. 236, 609], *Uromyces fabae* on broad bean, *U. trifolii* on red clover (*Trifolium pratense*), *Leveillula* [*Oidiopsis*] *taurica* on *Catalpa speciosa* and other hosts, *Mamianiella coryli* on *Corylus avellana*, *Massariella palmarum* on date palm, *Pseudopeziza medicaginis* on lucerne, *Ascochytella piricola* [ibid., xiii, p. 493] (syn. *Ascochyta piricola*) on living apple leaves, *Botryodiplodia malorum* [*Physalospora mutila*: ibid., xvii, p. 69] on medlar, *Cytospora chrysosperma* on poplar (*Populus nigra*) [ibid., xix, p. 623], *Septoria graminum* [ibid., xviii, p. 297] on wheat, *S. mori* [*Cercosporella maculans*] on mulberry [ibid., xv, p. 67], *S. piricola* [*Mycosphaerella sentina*] on pear, *S. populi* on poplar (*P. nigra*) [ibid., xvii, p. 83], *Cercospora circumscissa* [ibid., xix, p. 582] on almond, *C. kaki* on *Diospyros lotus* [ibid., xvii, p. 699], *C. punicae* on pomegranate [ibid., ix, p. 613], *Polythrincium* [*Dothidella*] *trifolii* on white clover (*T. repens*) [ibid., xx, p. 583], and *Stigmina platani* [*Mycosphaerella stigmina-platani*] on *Platanus orientalis* [ibid., xvii, p. 492].

GARCÉS-OREJUELA (C.). **Estudios micológicos colombianos. Dothideales.** [Colombian mycological studies. Dothideales.]—*Caldasia, 1941*, 2, pp. 75–87, 18 figs., 1941.

Included in this critically annotated list of 19 Dothideales of Colombia, comprising one new genus, *Phaeotrabutia*, designed to accommodate the black-spored species of *Trabutia* [cf. *R.A.M.*, xvii, p. 347], and seven new species, are *Phyllachora maydis* on maize [ibid., xi, p. 225] and *P. gratissima* on avocado [ibid., ix, p. 230].

WHITE (W. L.). **A monograph of the genus Rutstroemia (Discomycetes).**—*Lloydia*, iv, 3, pp. 153–240, 75 figs., 1941.

*Rutstroemia*, as here maintained, is a small genus of saprophytes, apparently confined to Europe and North America. It is of interest because its species may be confused with the Amenticolous species of *Ciboria* and certain foliicolous representatives of *Sclerotinia*. The species form stromata which appear as black lines in woody tissues, leaf petioles, and veins, and spermatia in minute, black, lenticular

spermogonia. The apothecia are produced in late summer or early autumn, and are firm and waxy, coriaceous, and prosenchymatous, with a middle gelatinous zone in the excipulum. The ascospores become uni- to pluriseptate at maturity. No species of *Rutstroemia* produces real conidia. Twenty-one species are treated in detail; the descriptions of 21 other accepted species are reproduced, and twelve are listed as excluded from the genus.

Greene (H. C.). **Notes on Wisconsin parasitic fungi. I.**—*Trans. Wis. Acad. Sci. Arts Lett.*, xxxii, pp. 77–83, 1940.

Brief descriptive notes are given on parasitic fungi collected in Wisconsin during 1938, including *Piggotia fraxini* on leaves of ash (*Fraxinus americana*) [*R.A.M.*, xxi, p. 54] forming large, isolated, circular, dull purplish-green spots up to 1 cm. in diameter, *Phleospora mori* [*Cercosporella maculans*] on mulberry (*Morus rubra*) [ibid., xv, p. 67], *Sphaeropsis ellisii* [*Diplodia pinea*] on Austrian pine (*Pinus laricio* [*P. nigra*] var. *austriaca*) [ibid., xviii, p. 57; xx, pp. 150, 340], and *Melanconium sphaeroideum* apparently parasitic on alder.

Miller (J. H.). **The Ascomycetes of Georgia.**—*Plant Dis. Reptr, Suppl.* 131, 93 pp., 1941. [Mimeographed.]

This is the first published list of the Ascomycetes of Georgia, United States; it comprises 221 genera and 761 species, based mostly on the collections of the author and his students during the last twenty years. He regards as mainly correct the names recorded for the recently monographed Operculate Discomycetes, also for *Dasyscypha*, *Lachnum*, *Lophodermium*, Hysteriales, Hypocreaceae, Diaporthaceae, and Xylariaceae; but many of the names recorded for other groups, such as the Allantosphaeriaceae, he regards merely as 'temporary expedients'. He recognizes four orders of Pyrenomycetes: the first two, Lophiostomales and Sphaeriales, have their asci and free paraphyses in 'true perithecia with definite walls and ostioles'; and the second two, Pseudosphaeriales and Dothideales, have their asci in stromatic locules.

The Lophiostomales, represented by the family Lophiostomataceae (eight species), include perithecial forms with a compressed ostiole and constitute a connecting link with the Hysteriales. The Sphaeriales comprise five families, Hypocreaceae, Xylariaceae, Allantosphaeriaceae, Diaporthaceae, and Phyllachoraceae, of which the last has been transferred from the Dothideales. *Anthostoma* and *Anthostomella*, genera with immersed perithecia and phaeosporous ascospores, are transferred from the Xylariaceae to the Allantosphaeriaceae. The Diaporthaceae [see next abstract], which is here enlarged to include both simple and stromatic genera, comprises 99 Georgian species in 19 genera, among them *Diaporthe*, *Endothia*, *Glomerella*, *Gnomonia*, *Melanconis*, and genuine *Valsa*, which is transferred from the Allantosphaeriaceae.

The Pseudosphaeriales [comprising the single family Pseudosphaeriaceae] are characterized by asci lying 'among interthecial threads or paraphysoids connected at the top and bottom of the locule', and include 153 Georgian species in 46 genera, among them *Botryosphaeria*, *Dibotryon*, *Didymella*, *Leptosphaeria*, *Ophiobolus*, *Parodiella*, *Physalospora*, *Pleospora*, *Pyrenophora*, and *Venturia*.

The Dothideales are now characterized by 'fasciculate asci arising from a central plectenchyma at the base of the cavity' and comprise the Dothideaceae, including *Dothidea* and *Dothidella* and, by transfer, the Mycosphaerellaceae, including *Didymellina*, *Guignardia*, *Mycosphaerella*, and *Pseudoplea*.

WEHMEYER (L. E.). **A revision of Melanconis, Pseudovalsa, Prosthecium, and Titania.**—viii+161 pp., 11 pl., Ann Arbor, The University of Michigan Press; London, Humphrey Milford, Oxford University Press, 1941. $2.50.

Dr. Wehmeyer is revising the stromatic Pyrenomycetes genus by genus, and, so far as material is obtainable, species by species. This book is a continuation of the author's well-known studies on 'The genus *Diaporthe* Nitschke and its segregates' [*R.A.M.*, xiii, p. 270].

Of the 60 species that have on occasion been called *Melanconis*, 25 are here accepted as good, and 27 excluded into seven other genera; material of eight has not been available. As finally presented, the genus comprises species with uniseptate ascospores, both hyaline and brown, appendaged and unappendaged, and with A-conidia, both hyaline and brown and from 0- to multiseptate.

Similarly, of the 37 species that have been placed in *Pseudovalsa* three are accepted as good, and the others excluded; seven with appendaged ascospores are transferred to *Prosthecium*, and one with one-spored asci to *Titania*.

*Calospora* of Saccardo's usage is suppressed, and its 40 species otherwise distributed, the type species to *Prosthecium*.

*Melanconis*, *Pseudovalsa*, *Prosthecium*, and *Titania* all agree with *Diaporthe* in finally filling the lumen of each perithecium with a mass of unattached asci; but the author does not commit himself to the thesis that this character calls for the erection of a family Diaporthaceae [see preceding abstract]. Some species that on occasion have been placed in *Melanconis* and *Pseudovalsa* or *Calospora* differ from all of them in the fact that their asci are permanently separated from one another by numerous filiform, persistent paraphyses, and are here referred to *Aglaospora*, *Massaria*, *Thyridaria*, or *Pseudotrichia*. Again, the author is not satisfied that they should accordingly be grouped in a special family Pseudosphaeriaceae [loc. cit.].

McKINNEY (H. H.) & HILLS (C. H.). **Mosaic, chlorosis and necrosis in virus-infected perennial Pepper caused directly by products of a deranged metabolism.**—*Science*, N. S., xciv, 2442, pp. 372–373, 1941.

In a study of mosaic (*Nicotiana* virus 1) in perennial pepper (*Capsicum frutescens*) [*R.A.M.*, xvii, p. 773], the level of virus concentration was found to be relatively low under all conditions of growth. When the leaves were wiped with virus, local necrotic lesions developed and the leaves abscissed. When the inoculated plants were cultured at a temperature near 32° C. (but not near 23°), small quantities of virus passed from the inoculated leaf, causing systemic infection, with necrosis of the branches, stems, and roots, and finally death, old plants being more resistant than young ones. Before abscission a secondary chlorosis usually developed in the leaf tissues outside the local infections. Of

the 125 lots of leaf tissue isolated over a period of five years from outside the inoculated zones before and during the progress of secondary chlorosis, none showed the presence of virus when tested. When inoculated woody chilli plants were cultured at near 32°, typical fully developed light and dark green mosaic mottling frequently appeared on new leaves remote from the inoculated areas, persisting sometimes for several days before necrosis set in. Virus was detected on the first signs of necrosis, but not before. The greatest concentrations of the virus could be found in or very near the necrotic cortex or cambium, while none was detectable in the necrotic xylem of the stem. When plants, maintained at near 32°, were inoculated in the lower stem or the upper part of the tap-root, necrosis, leading to wilting of the plants, occurred considerably in advance of the virus in the xylem, but not in the cortex. It was found that very chlorotic leaf tissues contained larger amounts of peroxidase and smaller amounts of oxidase and catalase than normal leaves on the same branches, indicating that the virus is capable of inciting profound changes in tissues remote from the virus-containing zones. It is concluded from these observations that the secondary chlorosis, the mosaic mottling, and the xylem necrosis are induced directly by translocated or diffused products of a deranged metabolism, which, in turn, is induced by relatively small amounts of virus in remote zones.

Silberschmidt (K.) & Kramer (M.). **A possibilidade da transmissão de doenças de virus pelas pulverizações com extratos de Fumo.** [The possibility of virus disease transmission by spraying with Tobacco extracts.]—*Biológico*, vii, 8, pp. 207–215, 2 figs., 1 graph, 1941. [English summary.]

When tobacco plants at the Experiment Station of the Biological Institute, Campinas, São Paulo, Brazil, were treated against insect pests with nicotine sulphate or extracts of tobacco powders (prepared by soaking in cold water for 24 hours, with or without subsequent concentration by heating), mosaic symptoms developed only as a result of accidental contamination, whereas in those sprayed with the expressed juice of diseased plants at a dilution of 1 per cent. contracted over 50 per cent. infection. There would thus appear to be little risk of transmission of the tobacco mosaic virus from the use of home-made extracts of powders of the type under discussion.

Karthaus (J. P.) & Thung (T. H.). **Het verenten van Tomaten op voor slijmziekte resistente onderstammen.** [The grafting of Tomatoes on stocks resistant to slime disease.]—*Natuurwet. Tijdschr. Ned. Ind.*, ci, 9, pp. 266–270, 3 figs., 1941.

With a view to their use as stocks for the grafting of tomatoes in the Buitenzorg district of Java, where slime disease (*Bacterium solanacearum*) is a limiting factor in production, a number of other Solanaceae were tested for their reactions to the pathogen in heavily infested soil at an altitude of 1,200 m. above sea-level. In preliminary trials in 1933–4, *Solanum torvum*, *S. mammosum*, and *S. aculeatissimum* showed a very high degree of resistance, all contracting only 1·7 per cent. infection compared with 55·2 per cent. for the commercial Wonder of

the Market tomato variety, the corresponding figures for *S. macrocarpum*, *Cyphomandra betacea*, *S. quitoense*, and eggplant (*S. melongena* var. *breviviolaceum*) being 3·3, 3·4, 6·7, and 18·2 per cent., respectively, and for the controls, consisting of interspersed rows of Eigenheimer potatoes, 98·5 per cent. In a large-scale grafting experiment in 1940 with *S. torvum* and other Solanaceae, including *S. mammosum*, *S. macrocarpum*, and *C. betacea*, the first-named gave the most encouraging results, the percentage of mortality in three separate tests involving 218 plants being only 10·6 per cent. The fruit of the grafted Wonder of the Market plants was of an agreeable aromatic, sufficiently acid flavour, in contrast to the insipidity of that of the same variety on eggplant stocks. The sole drawback of *S. torvum* as a stock is the relatively lengthy period of 2½ months required for the seedlings to reach a large enough size for this purpose. A species of *Cercospora* apt to attack the older leaves of the stock in damp weather may be combated by spraying with 1·5 per cent. Bordeaux mixture.

BEWLEY (W. F.). **Tomatoes: cultivation, diseases and pests.**—*Bull. Minist. Agric., Lond.*, 77, iv+78 pp., 4 figs., 1941. 2*s.* 0*d.*

The present (seventh) reprint of the bulletin of the same name, originally published in 1934 [*R.A.M.*, xiii, p. 659], introduces certain rectifications in the statistical information and other revision suggested by the experience which is constantly accumulating at the Cheshunt Experimental and Research Station.

SHAPOVALOV (M.), BLOOD (H. L.), & CHRISTIANSEN (R. M.). **Tomato plant populations in relation to curly-top control.**—Abs. in *Phytopathology*, xxxi, 9, p. 864, 1941.

Severe outbreaks of curly top are stated frequently to reduce the Utah tomato crop by over 50 per cent. During the past five years the writers have conducted experiments involving a modification of the customary planting density of 3,560 plants per acre with a 3½ ft. spacing between the hills. The reduction in the incidence of infection in the densest plantings of quadruple populations ranged from 4·4 to 30 per cent., with a corresponding yield increase of 2·9 to 9·6 tons per acre. With a given number of plants per acre, somewhat better control of curly top was secured by setting two plants in each hill instead of single-plant hills more closely spaced, though the latter tended to give higher yields.

COLQUHOUN (T. T.). **Black dot root rot of Tomatoes.**—*J. Agric. S. Aust.*, xliv, pp. 572–575, 2 figs., 1941.

Tomato black dot root rot (*Colletotrichum atramentarium*) [*R.A.M.*, xix, p. 49] having caused considerable trouble in commercial glasshouses near Adelaide in 1935, an experiment was conducted (under commercial glasshouse conditions) which showed that leaving the soil roughly dug for 2½ months in summer reduced the percentage of affected plants to 69·7, as compared with 83·5 for plants grown in roto-tilled soil left for the same period. Moisture had no effect. In a further test the fungus remained viable for at least 11 months in both moist and dry soil, in the absence of host plants.

Champlin (S. H.). **Tomato experiments support belief that variety reduces overtime pack.**—*Canning Age*, xxii, 5, pp. 255–257, 15 graphs, 1941.

In connexion with a series of observations on the yield characteristics and average weight of 25 canning tomato varieties at different stages of ten bearing weeks in Virginia in 1940, it is mentioned that a week's spell of hot weather in July resulted in an attack of blossom-end rot [*R.A.M.*, xx, p. 3], which is attributed to inadequate transfer of moisture from soil to plant when high temperature and low humidity induce excessive evaporation. The sole practicable remedy appears to consist in a system of overhead irrigation forming a mist over the plants to prevent evaporation from the foliage.

Collins (C. W.). **Studies of Elm insects associated with Dutch Elm disease fungus.**—*J. econ. Ent.*, xxxiv, 3, pp. 369–372, 1941.

According to unpublished observations by T. H. Jones and C. S. Moses, *Ceratostomella ulmi* was obtained from 6·9, 5·8, 7·7, and 5·71 per cent. of the *Scolytus multistriatus* beetles and from 4·3, 2·4, 3·3, and 0·7 per cent. of *Hylurgopinus rufipes* collected on felled healthy elm trees in New Jersey [*R.A.M.*, xv, pp. 327, 691, and below, p. 106] and cultured in 1936, 1937, 1938, and 1939, respectively. Of numerous other species of insects taken in 1936, only small percentages of the following were contaminated by the fungus: *Xylosandrus germanus* (Blfd), *Xylobiops basilare* (Say), *Magdalis armicollis* (Say), and *Conotrachelus anaglypticus* (Say). Particulars are given of the methods employed by the beetles in boring into the trunks and limbs of elm trees, their breeding and feeding habits in relation to the transmission of *C. ulmi*, and the possibilities of control by means of insecticides, all these observations forming a part of researches on the Dutch elm disease in which the Morristown, N.J., laboratory of the Bureau of Entomology and Plant Quarantine is at present engaged.

Howard (F. L.). **Antidoting toxin of Phytophthora cactorum as a means of plant disease control.**—*Science*, N. S., xciv, 2441, p. 345, 1941.

The toxic effect of filtrates of liquid media in which *Phytophthora cactorum* [*R.A.M.*, xx, p. 326] had grown, was inactivated, in experiments at Rhode Island, by the addition of 0·5 per cent. aqueous solution of the di-hydro-chloride salt of di-amino-azo-benzene plus a solvent and penetrant ('helione orange'). Thus, healthy maple [*Acer*] trees injected with the toxic filtrate died, while those injected with the same filtrate to which the salt had been added remained unharmed. Over 350 confirmed maple trees naturally infected with *P. cactorum* stopped 'bleeding' and markedly improved in growth when injected with the antidoting chemical. It is not yet clear whether the trees were definitely cured, but the results are taken to indicate some possibilities of practical disease control.

Wright (E.). **Control of damping-off of broadleaf seedlings.**—*Phytopathology*, xxxi, 9, pp. 857–858, 1941.

In field and greenhouse trials in Federal nurseries in the Great Plains

region of the United States, damping-off of broad-leaved tree seedlings, chiefly due to *Rhizoctonia* [*Corticium*] *solani* and *Pythium ultimum*, tended to be more severe following legumes than in succession to cereals. Chemical analyses for soluble (nitrate) nitrogen indicated that the incidence of infection increased in direct proportion to the nitrate content of the soil. For the best nursery results the preceding crops should be turned under at least a month before the tree seed is sown. A heavy reduction in the amount of damping-off was secured by the application of glucose to the seed-bed at sowing time, a final American elm (*Ulmus americana*) stand of 293 per cent. being obtained on treated as compared with control plots of sandy loam, while soil analyses made a fortnight after the treatment showed a marked decrease in nitrate nitrogen. The addition of sugar to the soil probably accelerates the growth of soil organisms, including fungi which utilize or bind the nitrates until the carbon source is depleted.

DAVIS (K. P.) & MOSS (V. D.). **Blister rust control in the management of Western White Pine.**—*Sta. Pap. north. Rocky Mtn For. Range Exp. Sta., Nissoula*, 3, 34 pp., 22 figs. (2 col.), 1 map, 1940. [Mimeographed.]

In this paper the authors discuss some practical silvicultural problems connected with the control of blister rust [*Cronartium ribicola*: *R.A.M.*, xx, p. 435] in the white pine [*Pinus monticola*] stands of the Inland Empire (Washington, Montana, and Idaho) by the suppression of the alternate *Ribes* hosts of the rust. Special emphasis is laid on the necessity of close integration of control measures with timber management. In particular, the cutting and slash disposal methods adopted in mature stands have a direct influence on the *Ribes* population. Good practices are those providing for prompt re-stocking of white pine, permitting a minimum number of *Ribes* seedlings to become established. Stand improvement in immature stands requires consideration from the point of view of infection conditions. Low type thinnings are the least desirable from the standpoint of *Ribes* suppression, whereas crown thinnings do not affect the *Ribes* problem adversely. Disease endurance of forest stands is of prime importance in relation to economic value, *Ribes* suppression, and probable rust damage. Any areas selected for protection should have an estimated production of at least 8,000 to 10,000 board ft. per acre. It is important to think in terms of board ft. production of western white pine rather than the number of *Ribes* bushes per acre or the percentage of infection of white pine. Anticipated damage must always be weighted against cost of control, and it is not essential that the disease be kept completely out of a stand provided the damage does not cause a reduction of normal yield or quality. Age, species composition, stand density, and likelihood of infection are the chief factors determining the amount of damage that the disease will cause, and the great need for more information on blister rust-timber management relationships is stressed.

ZENTMYER (G. A.). **Cytospora canker of Italian Cypress.**—*Phytopathology*, xxxi, 10, pp. 896–906, 2 figs., 1 map, 1941.

Columnar Italian cypresses (*Cupressus sempervirens* var. *stricta*) along

a narrow belt of the Californian coast have been suffering during the last twelve years from a disease involving the development on the trunk and branches of reddish-brown cankers, smooth in the early stages, later becoming cracked and distorted with a heavy flow of resin, and bearing on their surfaces erumpent stromata, 0·5 to 1 mm. in diameter and 0·25 to 0·5 mm. in thickness, with 4 to 7 radiating locules, 300 to 600 $\mu$ in diameter, and greenish-grey, truncate ostioles protruding through the epidermis. The foliage of affected trees turns yellow, subsequently brown, persisting on the branches for some time after death in the form of 'flags' strongly contrasting with the normal green colour of the leaves. A 25-ft. tree has been observed to bear up to 30 cankers, and cypresses 30 ft. high and 6 in. in diameter at the base have succumbed to the disease within a year after the ingress of the pathogen by natural means. In an area less than ½ mile square in the Berkeley district, in which 32 out of 62 trees were diseased in 1936, 20 had been removed on account of the canker by 1938, while 29 of the remaining 42 were infected. The increase in length of 12 natural cankers from 18th July to 17th October, 1937, ranged from 4·5 to 32 cm. with an average of 14·7 cm. The high mortality from the canker and the unsightliness of the diseased trees is leading to the gradual abandonment of *C. sempervirens* var. *stricta* as an ornamental species in the affected area, and its replacement by a suitable substitute for formal planting is likely to present considerable difficulties.

The causal organism of the canker, other less important hosts of which are *C. sempervirens* var. *horizontalis*, *C. macrocarpa*, and *C. glabra*, is a new form, *littoralis*, of *Cytospora cenisia* Sacc., characterized by few locules in the stroma. The caespitose, simple or branched conidiophores, 8·5 to 15 by 1·5 to 2 $\mu$, bear hyaline (strontian yellow in the mass), allantoid conidia 3 to 7·2 by 0·6 to 1·5 (4·6 by 1) $\mu$. The minimum, optimum, and maximum temperatures for the growth of the fungus in culture were determined as approximately 1°, near 19°, and 25° C., respectively, its low temperature requirements being apparently related to its known occurrence only in the cool coastal zone of California.

Control should be based on the avoidance of wounds, the protection of pruning cuts with Bordeaux or asphalt paints, and the stringent exclusion of diseased nursery stock from non-infected areas.

Rankin (W. H.), Parker (K. G.), & Collins (D. L.). **Dutch Elm disease prevalent in bark beetle infested Elm wood.**—*J. econ. Ent.*, xxxiv, 4, pp. 548–551, 1941.

The following are among the conclusions drawn by the writers from the results of an examination of a special series of dead elm wood samples collected in six counties of New York in 1939–40 to determine the frequency of *Ceratostomella ulmi* as a saprophyte in association with the bark beetles *Scolytus multistriatus* and *Hylurgopinus rufipes* [see above, p. 102]. The saprophytic existence of the fungus is neither a newly acquired habit nor a temporary one dependent for its continuance on the parasitic phase, since the presence of elms killed by the disease is not necessary to replenish the supply of fungus-carrying beetles in a given locality. *C. ulmi* appears to be migrating into new

territory in its saprophytic stage, the percentage of samples containing fungus-carrying beetles being as large at the margin of advance into a new region as in one where infection has been present for several years. The rate of lethal infection of living elms (an annual average of one diseased tree per five square miles for Orange County) is regarded as very low considering the number of sources of spread, the numbers of beetles carrying the pathogen on emergence from such sources, and the number of actual inoculation points made by the insects in living elms. Spread of the fungus to increasing numbers of living elms by parasitic activity alone, thereby inducing an epiphytotic build-up calculated to kill off the species, is considered to be no longer a justifiable expectation. Conversely, intensified local outbreaks have been found to be definitely connected with beetle-infested material produced by factors independent of the parasitic stage in the life-history of *C. ulmi*.

The annual incidence of elms destroyed by *C. ulmi* is thought to be largely dependent on a low rate of successful infection originating from the current volume of bark beetle breeding material produced by the combination of all factors involving the death of the wood or trees.

Baechler (R. H.). **Resistance to leaching and decay protection of various precipitates formed in wood by double diffusion.**—*Proc. Amer. Wood Pres. Ass.*, xxxvii, pp. 23–31, 2 figs., 1941.

The writer fully describes a series of experiments at the Forest Products Laboratory, Madison, Wisconsin, to determine (1) the possibility of precipitating materials of very low solubility in wood by a two-stage diffusion treatment, and (2) the resistance to leaching and the toxicity to wood-destroying fungi of certain substances thus formed. In preliminary tests on 15-in. lengths of green aspen [*Populus tremuloides*] fence posts, 4 in. in diameter, steeped for five days in copper sulphate and then transferred to a 20 per cent. solution of sodium chromate for a similar period, the absorption of each salt was found to amount to roughly 3 per cent. of the dry weight of the wood. When the order of treatment was reversed, a marked deficiency of copper sulphate resulted. Similarly, in other combinations, when the wood was first treated with the salt of a heavy metal (magnesium, copper, or nickel), subsequent penetration by sodium arsenate or sodium chromate was comparatively rapid, whereas the prior application of the sodium salts greatly retarded the infiltration of the heavy metals.

The outcome of leaching trials on (*a*) basswood [*Tilia*] blocks, 2 by 1 by 0·6 in., and (*b*) sections of green maple [*Acer*] fence posts, 6 in. in diameter with a 2-in. band of sapwood, showed that the chromates and arsenates of copper and nickel and magnesium ammonium arsenate, formed in the wood by the successive steeping method, are leached out more slowly than are soluble salts. The loss of weight in these blocks following four months' exposure to pure cultures of the fungus known as Madison 517 [? *Polyporus tulipiferus*: *R.A.M.*, xx, p. 188], *Coniophora cerebella* [*C. puteana*], *Poria incrassata*, and *Lenzites trabea* by a modification of the Kolle flask method was as follows: copper sulphate+sodium arsenate, 0·37, 0·48, 16·8, and 0·06 per cent., respectively; nickel sulphate+sodium arsenate, 1·27, 1·14, 10·6, and 14·2; copper sulphate+sodium chromate, 3·55, 11·6, 27·3, and 5·24; nickel

sulphate+sodium chromate, 8·35, 16·9, 19, and 23·5; copper sulphate, 6·67, 32·5, 19·4, and 0·71; nickel sulphate, 13, 39·3, 19·7, and 58; sodium arsenate, 26·3, 2·3, 20, and 51·2; sodium chromate, 31·8, 35·4, 34·7, and 42·1; zinc chloride, 24·8, 39·4, 26·4, and 64; and untreated, 32·2, 30·9, 24, and 49·2.

ANDREWS (L. K.), GOTTSCHALK (F. W.), & JOHNSON (J. P.). **Service records for Wolmanized lumber.**—*Proc. Amer. Wood Pres. Ass.*, xxxvii, pp. 54–80, 12 figs., 1941.

Two tables of service records for timber treated with Wolman salts [*R.A.M.*, xix, p. 249] in the United States from 1925 to the date of writing are presented, the data in (1) being summarized by years, species of wood, average preservative retention, volume, and removals, and (2) by individual installations. Of the total of 21,475,079 board ft. treated (of which 13,299,708 ft., or 61·8 per cent., had given 10 to 15 years of service), only 0·2 per cent. was removed on account of decay.

SCHMITZ (H.), BUCKMAN (S. J.), & VON SCHRENK (H.). **Studies of the biological environment in treated wood in relation to service life. I. Changes in the character and amount of 60/40 creosote-coal tar solution and coal tar and the decay resistance of the wood of Red Oak crossties after three years of service.**—*Proc. Amer. Wood Pres. Ass.*, xxxvii, pp. 248–297, 3 figs., 3 diags., 1 graph, 1941.

In this study, the first of a projected series bearing on the biological environment in treated wood in relation to service life, an investigation was made of the chemical and physical characteristics, after three years' service on the Chesapeake and Ohio Railway, of four red oak [*Quercus* spp.] sleepers impregnated by the Lowry process with net absorptions of 3 to 4 gals. 60–40 creosote-coal tar solution each, and four with comparable amounts of coal tar.

In both treatments, the most extensive changes were found to occur in the outer zones, with progressively slighter modifications from the exterior to the interior. There was a greater increase in specific gravity, and heavier losses both of the lower boiling fractions and tar acids from the bottom than from the top outer zone of the sleepers. The creosote-coal tar solution induced more striking alterations in the wood than the coal tar, an average of 17·3 per cent. of the former being lost from the top and bottom outer zones of the sleepers during the period of service compared with 9·2 per cent. of the latter. The toxicities of both preservatives extracted from the outer zones, gauged by their action on malt agar cultures of *Trametes serialis* and Madison 517 [? *Polyporus tulipiferus*: see preceding page], were much lower at the end of the test than at its inception, the decrease being sharper in the bottom than in the top zone. At the outset of the trials, the toxicity of the creosote-coal tar solution considerably exceeded that of the coal tar alone, but at the close of the three year period the two preservatives were about equal in this respect. Test blocks cut from seven of the eight sleepers were generally resistant to infection by *Lenzites trabea* and *Daedalea quercina* under optimum or suboptimum conditions for the growth of the fungi, the coal tar being as effective alone as with an admixture of creosote for the end in view.

In conclusion the writers discuss the ecological factors affecting the growth of fungi in treated sleepers, including water content, oxygen, inorganic nutrients, temperature, and (most important of all) the preservative itself. It is shown that the habitat offered to the organisms by the sleeper as a whole is quite different from that provided by the small test blocks into which it has to be cut for experimental purposes, and the changes in the various above-mentioned factors involved in such methods must be considered in an evaluation of the results.

WIRKA (R. M.). **Comparison of preservatives in Mississippi fence post study.**—*Proc. Amer. Wood Pres. Ass.*, xxxvii, pp. 365–379, 1941.

Notes are given on a large number of preservatives and other chemicals under test on wooden fence posts in the United States since 1937. No conclusions can as yet be drawn as to the relative effectiveness of the different materials in affording protection against decay, except that used crank-case oil and 10–90 creosote-used crank-case oil solution have proved ineffective.

HELPHENSTINE (R. K.). **Quantity of wood treated and preservatives used in the United States in 1940.**—*Proc. Amer. Wood Pres. Ass.*, xxxvii, pp. 410–432, 10 graphs, 1 map, 1941.

During 1940, 223 wood-preserving plants were in active operation in the United States [cf. *R.A.M.*, xx, p. 188]. Of these, 158 were pressure plants, 48 open-tank, while 17 were equipped for both methods of treatment. The total quantity of wood treated was 265,473,149 cu. ft., an increase of 20,253,271 cu. ft. (8·26 per cent.) over the previous year's figures. The consumption of creosote amounted to 174,625,305 gals., an increase of 10,761,046 gals. (6·57 per cent.) over the quantity used in 1939, while a rise was also reported in creosote-petroleum (64,370,186 gals., an excess of 13,741,223 gals., or 27 per cent., over the previous year). There was a reduction in the amount of pure zinc chloride of 731,517 lb. (over 37 per cent.), but the amount of chromated zinc chloride used (3,960,596 lb.) was 1,390,343 lb. (54 per cent.) in excess of the corresponding quantity for 1939. Decreases of 138,568 lb. of Wolman salts and of 14,233 lb. zinc-meta-arsenite were registered in 1940 as compared with the previous year. The quantity of celcure used (exclusively for open-tank treatment) in 1940 was 242,739 lb., this being the first year in which the salt has been recorded apart from other miscellaneous preservatives.

BOWEN (J. W.) & LOMBERG (B. R.). **The preservation of mining timber, with particular reference to the effect of air pressure, moisture content, initial vacuum and temperature on the absorption of preservative.**—*J. S. Afr. Inst. Engrs*, xxxix, 1, pp. 1–14, 2 diags., 7 graphs, 1940.

The following conclusions were drawn from an investigation at the Timber Research Laboratory of the Transvaal Chamber of Mines of the factors affecting the durability of underground timbers (*Acacia mollissima* and *Eucalyptus saligna*) treated with the so-called 'yard mixture', consisting of 3 per cent. zinc sulphate and 0·3 per cent. triolith [*R.A.M.*, xix, p. 269], the composition of which is given as 55 per cent. sodium fluoride, 35 per cent. sodium bichromate, and 10

per cent. dinitrophenol. Pressure was found to play a decisive part in absorption, the latter being directly proportional to the former up to 110 lb. per sq. in. The maximum air pressure available should be used at all timber preservation plants. Whenever extra durability is required, it is advisable to increase the time during which the timber is subject to pressure, the amount of preservative absorbed in 20 minutes, for instance, being only 82 per cent. of that taken up in an hour. No significant advantage was derived from the use of heated solutions for wood absorbing the preservative with comparative facility, such as *E. saligna*, for which the normal temperature of 20° C. is adequate. Buying specifications should contain a clause providing for the seasoning of timber for a reasonable period before dispatch to the mine, thereby substantially prolonging its effective life. *E. saligna* absorbs considerably more preservative than *A. mollissima*, but since the latter is more durable in the untreated state, little difference was found between the two as regards length of life after impregnation. An initial vacuum prior to the application of pressure greatly increases absorption, especially in timbers offering resistance to impregnation such as *A. mollissima*. For maximum absorption for mixed timbers the writers advocate 23 in. vacuum for ten minutes, followed by 110 lb. pressure for the same period. It is further recommended that, at appropriate intervals, a mixture of 4 per cent. zinc sulphate and 0·6 per cent. triolith be made up and applied to all timbers required for special purposes, which can then be stored until needed. The total cost of treatment (including labour and depreciation) of 1,000 cu. ft. by the new formula is estimated at £8. 3*s*. 2*d*., as against £5. 15*s*. 5*d*. for the original one; where zinc sulphate occurs as a waste product, however, the charge of £3. 4*s*. 5*d*. (£2. 8*s*. 4*d*. for the lower strength) for this item need naturally not be included.

A detailed description is given of two typical plant lay-outs and methods of operation, and a discussion following the paper is reported.

Proctor (P.). **Penetration of the walls of wood cells by the hyphae of wood-destroying fungi.**—*Bull. Sch. For. Yale* 47, 31 pp., 22 pl., 1941.

After stating that most wood-destroying fungi produce at least two types or sizes of hyphae, the small, actively-growing ones penetrating the cell walls without appreciable reduction in diameter, while, in the earlier stages of decay, the larger ones usually become constricted on contact with the cell wall, and effect the passage at a reduced diameter, with the result that the bore holes are frequently of approximately the same diameter, the author gives a full account of an investigation of the mode of hyphal penetration of plant tissues by wood-destroying fungi. The organisms used were *Fomes annosus*, *F. pini*, *Lenzites trabea*, *Polyporus schweinitzii*, *Poria weirii*, and *Trametes serialis*, and inoculations were made on *Pinus strobus*, *Tsuga heterophylla*, *Pseudotsuga taxifolia*, and *Thuja plicata*. Ultra-violet photomicrography with the 3650 A spectral line was used to record all observations, while the histological methods used were those preserving the natural conditions to the highest possible degree.

The evidence obtained showed that penetration of the walls of wood

cells is accomplished by (1) the secretion of enzymes at the tips of penetrating hyphae, and (2) the total, local dissolution of the cell wall by enzymic activity in advance of actual passage through the cell wall. Penetration is effected through a pre-formed passage without actual contact between the hypha and the penetrated cell wall, though contact with the cell wall at the first point of penetration may, possibly, stimulate initiation of enzymic activity. In every instance, the tip of the hypha was preceded by a cavity of significant proportions. Careful examination of hundreds of bore holes, in some cases with polarized light, gave no support to the view that mechanical force plays any part in penetration.

PALMER (J. W.). **Creosoting of poles. New and efficient method.**—*Aust. Timb. J.*, vii, 2, pp. 70–71, 2 figs., 1941.

Details are given of an economical new method of impregnating the entire sapwood of hardwood poles with creosote, experiments with which, in progress since 1934 at the Braemar State Forests, New South Wales, on spotted, grey, and red gum [*Eucalyptus maculata, E. tereticornis*, and *E. rostrata*] and grey box [*E. polyanthemos*], indicate the possibility of an added life of 33 per cent. or more. In brief, the method consists in fitting a rubber cap to the butt end of a pole, raised 3 ft. higher than the top, the creosote being admitted to the cap by means of a $\frac{3}{4}$-in. pipe, attached to a 5-gal. drum filled with the preservative and elevated 23 ft. above the ground. A pressure of roughly 9 lb. per sq. in. is thus obtained, the creosote being quickly forced through the sapwood from one end of the pole to the other. Impregnation of the pole is complete after six days.

**Twentieth Annual Report of the Southern Forest Experiment Station January 1, 1940–December 31, 1940.**—39 pp., [1941].

The following items of phytopathological interest occur on pp. 20–22 of this report. The best control of fusiform rust (*Cronartium fusiforme*) on slash pines [*Pinus caribaea*: *R.A.M.*, xx, p. 187] at a Brooklyn (Mississippi) nursery in 1940 was obtained by spraying with Bordeaux mixture 8–8–100 plus 1 pint santomerse (salt of a substituted aromatic sulphonic acid, in aqueous solution), two applications a week being given for a month from the appearance of the first uredosori of the rust on the alternate oak hosts in the vicinity, followed by one a week for the next month, all treatments ceasing on 3rd June, by which time the peak of sporidial production was past. A reduction in the incidence of infection from 13 to 1 per cent. was secured by this schedule. Other combinations tested, in descending order of toxicity to the pathogen, were Bordeaux mixture with (*a*) an emulsion of raw linseed oil and fish oil soap, (*b*) casein spreader, copper hydro with santomerse, and dry lime-sulphur with (*a*) santomerse, (*b*) casein spreader.

Constructional practices found to contribute to serious [unspecified] decay in wooden buildings in the southern United States included (1) the erection of dirt-filled porches with no protection for the sill behind the fill; (2) the use of untreated wood of low decay resistance in contact with moist concrete or soil or for exterior steps, rails, porch floors, and the like; (3) the presence of wood refuse under the buildings; (4) inadequate substructural ventilation; (5) rain seepage into open joints in exterior woodwork; and (6) leakage in roofs and plumbing.

**Wood preservatives.**—11 pp., Madison, Wisconsin, For. Prod. Lab., U.S. Dep. Agric., 1941. [Mimeographed.]

In this revised edition useful notes are given on a large number of materials used for timber preservation in the United States.

Haskell (R. J.) & Doolittle (S. P.). **Vegetable seed treatments.**—*Fmrs' Bull. U.S. Dep. Agric.* 1862, 16 pp., 4 figs., 1940.

In this useful bulletin recommendations are given for treating all kinds of vegetable seeds, roots, and tubers against various diseases, together with short directions for carrying out these treatments.

Green (D. E.). **Hygiene in the war-time vegetable garden.—IX. X.**—*J. R. hort. Soc.*, lxvi, 9, pp. 326–332, 2 pl. (preceding p. lv); 10, pp. 417–422, 6 figs. (between pp. lviii and lix), 1941.

These further instalments of the writer's series of instructions for the care of British war-time allotments [*R.A.M.*, xx, p. 506] include observations on a number of well-known diseases of onions and related crops [ibid., xx, p. 442], carrots, parsnips, scorzonera, and salsify.

Wade (B. L.) & Andrus (C. F.). **A genetic study of common Bean mosaic under conditions of natural field transmission.**—*J. agric. Res.*, lxiii, 7, pp. 389–393, 1941.

In field trials at Charleston, South Carolina, the behaviour of the $F_1$, $F_2$, and $F_3$ generations from a cross between the bean (*Phaseolus vulgaris*) varieties Stringless Black Valentine and U.S. No. 5 Refugee and the reciprocal indicated that the resistance of the U.S. No. 5 Refugee variety to common bean mosaic virus [*R.A.M.*, xx, p. 245] is dominant to the tolerance of Stringless Black Valentine (which showed a definite mosaic pattern and marked symptoms), and that a single factor is responsible for the resistance. There were no significant differences in genetic behaviour between the cross and its reciprocal.

Porter (R. H.). **Seed-borne organisms and plant quarantines.**—*J. econ. Ent.*, xxxiv, 4, pp. 543–548, 1941.

In this paper, read before the Section of Plant Quarantine and Inspection, American Association of Economic Entomologists, at a meeting at Philadelphia in December, 1940, the author discusses from the following angles the interrelation of seed-borne organisms of fungal, bacterial, and virus origin and plant quarantines, with numerous illustrations of concrete examples: (1) the extent to which disease-producing agents are carried by seed; (2) the relative importance of determining the pathological condition of seed stocks in intra- and international commercial transactions; (3) methods for the detection of seed-borne organisms; and (4) the possibility and practicability of establishing proper facilities for the assistance of plant quarantine officials engaged in the regulation of seed commerce.

**Service and regulatory announcements April–June, 1941. Plant quarantine import restrictions, Dominion of Canada.**—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 147, pp. 56–61, 1941.

A summary is given of the plant quarantine import restrictions obtaining in the Dominion of Canada.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
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# APPLIED MYCOLOGY

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CHANDLER (F. B.). **Mineral nutrition of the genus Brassica with particular reference to boron.**—*Bull. Me agric. Exp. Sta.* 404, pp. [4]+ 307–400, 64 figs., 1941. [Abs. in *Exp. Sta. Rec.*, lxxxv, 5, pp. 631–632, 1941.]

In sand and water cultures the symptoms of boron deficiency in *Brassica* spp. (including cauliflower and swede) [cf. *R.A.M.*, xvii, p. 496; xviii, pp. 428, 817; xx, p. 554], which normally contain insufficient boron in their seeds to develop the cotyledons and first true leaves, were curling, rolling, and rugosity of the leaves, with chlorosis of the margins, swelling, splitting, and a corky appearance of the stems and petioles, accompanied by brittleness of the latter, development of brown areas in the stems, and a reduction in the size and quality of the edible portions. The undifferentiated cells of boron-deficient tissue elongated at random, thereby crushing other internal cells or producing swellings on the petiole and stem surfaces. In severe cases the cork cambium was not formed at all, and even when present it did not give rise to normal cells in boron-deficient plants. The root tip was the first part of the plant to show signs of boron deficiency (within a few days), and the apical meristem the last. The maximum total plant weight was obtained by continuous supplies of 0·3 or 0·5 p.p.m. boron.

GREIS (H.). **Die Pustelkrankheit der Zuckerrüben.** [The pustule disease of Sugar Beets.]—*Phytopath. Z.*, xiii, 4, pp. 369–374, 3 figs., 1941.

The fungus responsible for the production of pustules arising from a yellow, mucilaginous coating near the lateral roots of sugar beets in the early summer of 1940 in Germany was identified on the basis of its conidial dimensions (45 to 55 by 4 to 5·5 $\mu$, average 52 by 4·8 $\mu$) as *Fusarium betae* [*F. merismoides*: *R.A.M.*, xvi, p. 790]. The results of artificial inoculation experiments showed that the pathogen, which frequently causes the death of the plants, especially when young, normally enters its host through wounds, but is also capable of penetrating wilting tissues, even in the absence of injury. Living foliage and inflorescences are not attacked, but when dead they afford a suitable substratum for the fungus, which is transmitted by way of the seed clusters, having been found by the author in a number of German and foreign samples. As a rule the pustules originate in the groove of the lateral roots and thence spread over more or less extensive areas

of the beet. The disease occurs only in very moist soils, so that repeated hoeing to ensure aeration is a promising method of control.

Coons (G. H.). **The status of leaf spot varieties.**—*Proc. Amer. Soc. Sug. Beet Technol., East. U.S. & Can., 1941.* [Abs. in *Sugar*, xxxvi, 11, p. 40, 1941.]

During 1940, agronomic evaluations were conducted [in Michigan] on U.S. 200×215 and allied varieties of sugar beet in relation to leaf spot [*Cercospora beticola*: *R.A.M.*, xx, p. 618] resistance, comparisons being made with Synthetic Check, a variety obtained by pooling equal quantities of nine European brands and using this mixture to produce a seed crop. In general, the data confirm the results of the 1938 and 1939 tests, viz., that U.S. 200×215 may be used to replace standard European varieties without reduction in sugar yields, while under conditions of exposure to leaf spot it is expected to be in great demand.

Lider (W. R.). **Variety adaptation determined from tests.**—*Sug. Beet Bull.*, v, 4, p. 68, 1941. [Abs. in *Sugar*, xxxvi, 11, pp. 40–41, 1941.]

In connexion with a series of varietal tests on sugar beets carried out by the Spreckels Sugar Company in California from December, 1939 to May, 1940, it is mentioned that in the March plantings where blight [? *Cercospora beticola*: see preceding abstract] was prevalent, U.S. No. 22 showed outstanding resistance, followed by U.S. 23, both slightly superior in this respect to U.S. No. 12, whereas U.S. 15 was almost equally susceptible with Old Type and should consequently be used exclusively for early plantings (1st December to middle or end of January).

Raleigh (G. J.), Lorenz (O. A.), & Sayre (C. B.). **Studies on the control of internal breakdown of table Beets by the use of boron.**—*Bull. Cornell agric. Exp. Sta.* 752, 16 pp., 3 figs., 1941.

Field and greenhouse experiments on the internal breakdown of beets, continued during 1938–40 in New York State [*R.A.M.*, xvii, p. 718], supplied evidence that the disease (stated to be identical with dry rot, internal black spot, and canker) is likely to be more severe and the response to boron less pronounced when high yields accompany unfavourable conditions than when yields are low as a result, possibly, of inadequate fertilization. Under conditions favouring severe breakdown, the application of 50 lb. borax per acre did not entirely eliminate the disease but gave satisfactory commercial control, especially when the crop was harvested immediately after the appearance of the first symptoms. For alkaline soils which have not been heavily fertilized with borax in the past, the application of borax thoroughly mixed with the fertilizer to supply 50 lb. borax per acre before the beets are planted is recommended as a standard practice. The application should be made soon after mixing and preferably a single-strength fertilizer should be used. On more acid soils, 50 lb. borax per acre may be injurious to beets, and it is almost certain to be injurious to boron-sensitive crops, such as beans, on any soil. It is thought advisable for the present to grow boron-tolerant crops such

as cabbage rather than beans on fields fertilized with 50 lb. borax per acre the previous year.

ANTONOVA (Mme S. P.). Антракноз Гороха. [Anthracnose of Peas.]—*Bull. Pl. Prot., Leningr., 1940*, 5, pp. 133–136, 1940.

Anthracnose of peas (*Colletotrichum pisi*) was observed on experimental fields of the Omsk Agricultural Institute [West Siberia] during 1938–9, severely attacking up to 39 per cent. and mildly affecting up to 100 per cent. of the harvested pods of some varieties. This is believed to be the first authentic record of the disease from the U.S.S.R., although it was listed by Jaczewski (1937) among those occurring in Russia. The symptoms and cultural characteristics largely correspond to those described from the United States [*R.A.M.*, i, p. 282; xii, p. 355]. Conidial fructifications were observed on spots on the leaves, stems, and pods in the form of small, orange-coloured, roughly circular cushions, 0·5 mm. in diameter, with abundant setae, up to 100 $\mu$ long and 9·0 $\mu$ thick. Artificial infection of pea seedlings succeeded with difficulty and only in the presence of wounds. Attempts to infect the leaves and stems of mature beans [*Phaseolus vulgaris*] failed, but conidia were formed on bean pods injured prior to infection. The disease was apparently not transmitted by seed. The symptoms caused by *C. pisi* are stated to resemble in most respects those produced by *Ascochyta pisi* and *A.* [*Mycosphaerella*] *pinodes* [ibid., xx, pp. 232–233], the main point of difference being the absence of lesions and discoloration in the seeds of plants affected by the anthracnose fungus.

COSTA (A. S.) & FORSTER (R.). **Duas molestias de virus de Feijoeiro (Phaseolus vulgaris L.).** [Two virus diseases of the French Bean (*Phaseolus vulgaris* L.).]—*Biológico*, vii, 7, pp. 177–182, 5 figs., 1941.

The two virus diseases of French beans (*Phaseolus vulgaris*) most commonly observed at the Santa Elisa Central Experiment Station, São Paulo, Brazil, are stated to be ordinary and dwarf mosaic caused, respectively, by *Phaseolus* viruses 1 and 2, as described by Pierce [*R.A.M.*, xiii, p. 488]. In experiments in 1936 to determine the reaction of some indigenous varieties and lines to ordinary mosaic, Bico de Ouro [Beak of Gold] (No. 242 and line 36–2036) proved to be highly resistant with 0·3 and 0·6 per cent. infection, respectively, while Vanguarda and Mulatinho were very susceptible and susceptible, respectively, with 16·8 and 7·8 per cent. infection, and four selections of Mulatinho contracted the disease in a milder form (1·5 to 3·4 per cent.). The influence of ordinary mosaic on the yield of affected plants was not as marked as in the case of the dwarf form, the average number of pods produced by each plant in a test of 20 ranging from 7 to 33 and the average number of seeds per pod from 1·7 to 4·8 in the case of the former disease, the corresponding figures for the latter in 18 plants being 0 to 12 and 0 to 5, respectively. The Vanguarda variety was the least susceptible to dwarf mosaic (0·3 per cent.), followed by Bico de Ouro No. 242 and New Mulatinho (variety No. 1) with 0·6 and 0·8 per cent., respectively, and Mulatinho the most so with 4·6 per cent. No evidence of seed transmission of ordinary mosaic was obtained, whereas in the case of the dwarf form all six plants of HM. 224–9 raised from infected

seed developed the typical symptoms, though the plants of eight other lines grown from infected seed remained healthy.

KLIMKE (A.). **Untersuchungen über die Corynespora-Krankheit der Gurke und die Resistenz deutscher Gurkensorten.** [Studies on the *Corynespora* disease of the Cucumber and the resistance of German Cucumber varieties.]—*Phytopath. Z.*, xiii, 4, pp. 401–435, 13 figs., 4 diags., 1941.

A tabulated account is given of the writer's recent studies at the Biological Institute, Dahlem, Berlin, on the mode of infection of cucumbers by *Corynespora* [*Cercospora*] *melonis* [*R.A.M.*, xii, p. 578], the influence of certain external factors on the course of the associated leaf blight, the virulence of the strains of the fungus tested, and the reactions to the disease of commercial varieties.

The pathogen was found to enter its host through the stomata and at the junctions of two or three epidermal cells, the appressorium-like elements formed giving rise to hyphae which spread through the tissues, especially those of the spongy parenchyma. Immature stems and petioles did not respond to inoculation with *C. melonis* even through wounds, while the fruits are also susceptible only in the ripe stage, though young ones may be infected by way of the perianth or stigma. The first symptom of the disease, appearing after an incubation period of four days at 25° to 35° C., is a lesion composed of three zones, the central pale to mid-brown, often fissured, the next of a darker colour, with prominent, still darker veins, and the outermost a narrow, dark olive-green ring. The surrounding chlorotic area is at this stage free from actual contamination, and its discoloration must be attributed to an advance action of the fungus; gradually the entire leaf turns yellow. The blight causes stunting of young plants.

Necrosis of the infected tissues falls into three phases, viz., (1) the cells of the chlorotic area are still living, as shown by their turgescence and their capacity for plasmolysis, but the membranes have already sustained damage, which is expressed by an irreversible uptake of the staining reagent (1 in 10,000 Nile blue in these tests); (2) the membranes turn brown and some of the cells contain a brown deposit which stains bluish-green, only a few being still capable of plasmolysis; (3) the cell lumen and the intercellular spaces near the smaller veins are filled with a brown substance, identifiable by its staining reactions as wound gum, the cells themselves having lost their turgescence and their brown, granular contents no longer reacting to staining.

In addition to high mean temperatures, *C. melonis* requires for its development and spread sharp fluctuations, experiments having shown that the lesions expand most rapidly when a maximum day temperature of 33° to 36° is followed by a minimum night temperature of 10° to 12°. The incubation period of the fungus was prolonged from four to five or six days by the daily withdrawal of light from the plants for 15 hours, thus confirming the observation that its pathogenicity is at a low ebb during the dark winter months.

No morphological differences were detected between three isolates of *C. melonis* obtained, respectively, from the mycological service of the Biological Institute (A), the Centraalbureau voor Schimmelcultures,

Baarn, Holland (B), and diseased cucumbers at the Horticultural Research and Experiment Station, Dahlem (C), but the last-named proved to be the most virulent and (B) the least so. In tests with pure cultures of the three isolates from carrot agar on 37 commercial varieties, only the English Butcher's Disease Resister and Spot Resisting gave any evidence of resistance, outdoor cucumbers proving particularly susceptible. There was a marked lack of uniformity in the reactions of samples of a given variety from different sources, and even between lots of the same origin, a phenomenon attributed to the frequency of cross-pollination among cucumbers and the propagation of 'impure' lines. The mode of infection in resistant plants does not differ from that described for susceptible ones, the parasite being merely inhibited from further growth without sustaining any injury.

Childs (J. F. L.). **The effect of aluminium on the deposition of copper on Cucumber leaves and on protection against Peronoplasmopara cubensis.**—Abs. in *Phytopathology*, xxxi, 9, p. 860, 1941.

The addition of increasing amounts of aluminium nitrate to copper phosphate and three proprietary cuprous oxide (cuprocide) suspensions enhanced their protective action against *Peronoplasmopara* [*Pseudoperonospora*] *cubensis*, the agent of cucumber downy mildew. Colorimetric analysis indicated that on the leaves of the host the deposition of copper phosphate and cuprocide H–112 (acid suspensions) was decreased in the presence of aluminium nitrate, whereas that of cuprocide H–167 (alkaline) was not affected. It would appear from these data that the increased protective capacity conferred by aluminium nitrate on the fungicides tested is more closely related to an intrinsic property of the compound than to its conversion of the negative charges of the copper-containing preparations into positive ones and the consequent changes in the deposition of the particles on the foliage.

Kreutzer (W. A.). **Host-parasite relationships in pink root of Allium cepa. III. The action of Phoma terrestris on Allium cepa and other hosts.**—*Phytopathology*, xxxi, 10, pp. 907–915, 3 figs., 1941.

Continuing his studies at the Colorado Agricultural Experiment Station on the relations between *Phoma terrestris*, the agent of onion pink root, and its host [*R.A.M.*, xix, p. 4], the author observed the mechanism of invasion by the fungus of Yellow Globe Danvers seedlings (*a*) at the edges of potato dextrose agar cultures of the pathogen, and (*b*) in artificially infested soil. In both cases the fungus formed small, irregular colonies on the root surfaces and invaded the host by means of hyphae showing characteristic constrictions at the point of entry. From the site of primary invasion the hyphae ramified throughout the cortex, both intra- and intercellularly, eventually forming pycnidial primordia in the cortical and epidermal cells. The extensive diffusion of pigment noted by Hansen [ibid., ix, p. 155] was not observed; in fact, the colouring substance was mainly confined to the hyphae. In cases of artificial inoculation, the fungus tended to sweep across the cortex in a hyphal mass, under which conditions the root speedily collapsed. Infection of the promeristematic region of the root tip was never observed. The fungus did not invade the living leaf tissue of the

bulb, but it was consistently present on the dead outer scales of mature bulbs or sets from one to three weeks after planting in infested soil, and was frequently isolated from the diseased material. On white varieties, such as Silverskin and Southport White Globe, the fungal blemishes were pink or purple-red, while on Yellow Globe Danvers or Red Wethersfield they assumed the form of water-soaked areas.

No evidence was obtained that the invasion of onion roots by *P. terrestris* afforded ingress to *Fusarium vasinfectum* var. *zonatum* f. 1, as suggested by Davis and Henderson [ibid., xvii, p. 7], the latter fungus having been experimentally shown to attack mechanically injured bulbs only.

In soil inoculation experiments on a number of crop plants likely to rotate with onions the following proved to be moderately or highly susceptible: Black Amber cane sorghum (*Sorghum vulgare* var. *saccharatum*), Early Fortune millet (*Panicum miliaceum*), Davis Perfect cucumber, Oxheart carrot, and spinach, besides Mountain Danvers and Red Wethersfield onions, while mild root symptoms developed on Edwards peas, Brunker oats, Trebi barley, Komar wheat, Improved Golden Bantam sweet corn and Minnesota 13 dent maize, Hubbard squash, Golden Honeymoon cantaloupe, Extra Early Osage muskmelon, New York Improved eggplant, and Super Snowball cauliflower, in addition to Sweet Spanish onions [ibid., xii, p. 547]. The pathogen was isolated from the roots of all the onion varieties tested, *P. miliaceum*, tomato, carrot, spinach, World Beater chilli, and soy-bean, the two last-named showing no characteristic external symptoms, as well as from the pericarps of germinating caryopses of barley, wheat, and the two maize varieties.

Tompkins (C. M.) & Tucker (C. M.). **Root rot of Pepper and Pumpkin caused by Phytophthora capsici.**—*J. agric. Res.*, lxiii, 7, pp. 417–426, 3 figs., 1941.

A destructive root rot of pepper (*Capsicum annuum* var. *grossum*) and pumpkin (*Cucurbita pepo* var. *condensa*) plants caused by *Phytophthora capsici* [*R.A.M.*, xx, p. 447] is described from the San Joaquin Valley, California. The inception and spread of the disease is favoured by excessive moisture, inadequate soil drainage, and high air temperatures. The disease appears very suddenly at mid-season, and the infected plants usually die promptly. The chief symptoms are wilting of leaves without noticeable change of colour; a blackish-brown discoloration of the stem near the soil with subsequent collapse and lodging of the plant; and a soft, water-soaked, blackish-brown, odourless decay of the roots and underground part of the stem. Inoculation of the soil in pots in the greenhouse with inoculum from cultures on wheat gave successful infection of young pepper and pumpkin plants with incubation periods of from 6 to 14 and from 12 to 21 days, respectively. All varieties of pepper and pumpkin tested in the greenhouse proved to be highly susceptible to the disease. Cross-inoculation of pumpkin with pepper isolates and vice versa gave positive results, all isolates causing damping-off of pepper and pumpkin seedlings in the greenhouse and rotting of pepper and pumpkin fruits in the laboratory. Both isolates were also pathogenic to squash (*C. maxima*), eggplant, and tomato.

MIDDLETON (J. T.). **Crown rot of Rhubarb caused by Pythium spp.**—Abs. in *Phytopathology*, xxxi, 9, p. 863, 1941.

*Pythium anandrum* [*R.A.M.*, xviii, p. 651], *P. oligandrum* [ibid., x, p. 211], and *P. ultimum* were isolated from rhubarb plants suffering from decay of the roots, crowns, buds, and petioles in the San Francisco and Los Angeles districts of California. Plants with infected roots are usually small and more or less chlorotic and often die. Infection progresses from the soft, water-soaked crowns to the bud scales and thence to the petioles, blighting the young shoots. Petioles pulled from plants with infected bud scales frequently rot in transit, spreading contamination throughout the container. Each of the three species produces identical symptoms independently. All are able to cause damping-off of rhubarb seedlings, *P. ultimum* being the most virulent in inoculation experiments.

JENKINS (W. A.). **An apparently undescribed disease of the Peanut (Arachis hypogaea).**—*Phytopathology*, xxxi, 10, pp. 948–951, 2 figs., 1941.

The leaves of groundnut plants growing on stiff clay soil, severely puddled following a heavy rain, at the Georgia Experiment Station, were observed in September, 1940, to bear on the lower surfaces roughly rectangular, deep brown to nearly black blotches, which appeared when viewed through the upper surface by transmitted light as mosaic patterns interspersed with definite, pin-point, necrotic areas. The petioles and young stems were also involved. Many of the affected plants were more or less chlorotic, stunted, poorly nodulated, and gave low yields, but typical symptoms were found on plants of normal colour. A histological examination of the affected foliage revealed necrosis of the dorsal epidermis and spongy mesophyll; partial discoloration of certain portions of the vascular system; large bodies, staining pale violet to dark brown with cotton blue, in the lower epidermal and mesophyll cells of limited areas; a 'tightly-packed' appearance of the palisade parenchyma and chlorosis of its chloroplasts; and scattered epidermal necrosis, corresponding to the above-mentioned pin-points. The disease has also been reported from the Coastal Plains of Georgia (on sandy soil), Texas, and Virginia. Several branches from affected plants grown in complete nutrient solutions made an entire recovery, indicating that a mineral deficiency may be responsible for the trouble.

COSTA (A. S.). **Uma molestia de virus do Amendoim (Arachis hypogaea L.). A mancha anular.** [A virus disease of the Groundnut (*Arachis hypogaea* L.). Ring spot.]—*Biológico*, vii, 9, pp. 249–251, 2 pl., 1941.

Since 1938–9 groundnuts from the São Paulo (Brazil) Agronomic Institute, planted at the Santa Elisa Central Experiment Station, have been observed to show primary leaf symptoms consisting of yellow, roughly circular lesions with dark red, necrotic dots on their surfaces and sometimes surrounded by a purplish margin, and secondary manifestations characterized by a compact growth composed of small, crinkled leaves, some with a rolled upper surface, and mosaic of the leaflets, the alternating dark green and greenish-yellow areas being disposed either in circular rings or in sinuous lines running more or less

parallel with the secondary veins. Necrosis may develop in some of the new growth and even extend to the petioles and stem. Affected plants cease to grow and their yield is immensely reduced; in very severe cases no crop is produced.

The disease, which was found not to be transmissible by way of the seed, is indubitably caused by a virus and probably conveyed by thrips from infected to healthy plants. It presents points of resemblance with 'vira cabeça' [? of potatoes: *R.A.M.*, xx, p. 502] and *Arachis* virus 1 [rosette]. Observations on the reactions to the virus of 45 groundnut varieties and selections under cultivation at the plant-breeding section of the Central Experiment Station indicated that Rasteiro and I.B.M. 16/4 are immune (0 per cent. infection) and I.B.M. 6/5 highly resistant (2·2), the remainder being more or less susceptible with percentages ranging from 5·1 (Roxo) to 50 (Amendoim Bravo).

LUTHRA (J. C.), SATTAR (A.), & BEDI (K. S.). **Determination of resistance to the blight disease [Mycosphaerella rabiei Kovačevski = Ascochyta rabiei (Pass.) Lab.] in Gram types.**—*Indian J. agric. Sci.*, xi, 2, pp. 249–264, 1941.

Of 392 types and collections of gram [*Cicer arietinum*] tested at the Lyallpur (Punjab) Agricultural College for their reaction to blight (*Mycosphaerella rabiei*) [*R.A.M.*, xviii, p. 86; xx, p. 514], all the Indian material proved susceptible, while of the foreign lines, Pois Chiches Nos. 4732, 199, and 281 (known locally as F8, F9, and F10, respectively), showed a high degree of resistance to the pathogen under varying environmental conditions. F8 is the best yielder of the three, besides possessing other desirable characters, and its seed is being multiplied for distribution among farmers in the blight-affected areas of the province; about 25,000 maunds [918 tons] were expected to have been available in 1940.

KHESWALLA (K. F.). **Foot-rot of Gram (Cicer arietinum L.) caused by Operculella padwickii nov. gen. nov. spec.**—*Indian J. agric. Sci.*, xi, 2, pp. 316–318, 3 figs. (1 col.), 1941.

Wilted gram (*Cicer arietinum*) plants from Karnal in the Punjab in 1938–9 and others from the Imperial Agricultural Research Institute, New Delhi (where the writer's studies were conducted) in 1939–40 yielded a very unusual fungus belonging to the Spheropsidales and designated *Operculella padwickii* n.g., n.sp., 85 isolates of which were obtained from eight out of nine varieties of the host, as compared with 111 of *Fusarium* [*R.A.M.*, xxi, p. 1].

The organism, which was grown in pure culture on oatmeal and potato dextrose agar, is characterized by unilocular, discoid to subglobose, erumpent, carbonaceous pycnidia, 270 to 810 $\mu$ in diameter, opening with an apical pore or by means of a hinged lid; conidiophores of two types, the shorter unbranched, averaging 83 $\mu$ in length, forming a compact layer over the entire inner pycnidial surface, and bearing spores terminally; the longer sparsely branched, sometimes septate, and producing spores on minute sterigmata. The spores are hyaline (yellowish-white in the mass), irregular in shape, continuous, and 7·4 to 16·6 by 5·5 to 11·1 $\mu$.

Diseased plants shrivel from the tip downwards, the leaves becoming chlorotic and finally dropping, while the collar turns dark brown; the roots and rootlets may also be involved. The stem and root tissues were permeated by a broad, granular, inter- and intracellular, septate mycelium, but no fruiting bodies developed on the host either in nature or in inoculation tests. The latter were consistently successful only by the method of soil infestation with cultures of the pathogen from a mixture of soil and maize meal, 14 to 81 per cent. of the plants arising from seeds sown in which contracted the wilt. Immersion of the seed in a spore suspension yielded a small proportion of infected plants.

CONNERS (I. L.). **Twentieth Annual Report of the Canadian Plant Disease Survey, 1940.**—xvi+104 pp., 1 map, 1941. [Mimeographed.]

In this report [cf. *R.A.M.*, xx, p. 101], the author states that during 1940 wheat stem rust (*Puccinia graminis*) did little damage in western Canada owing to the use of resistant varieties, though in a few areas, especially in south-central Saskatchewan, severe damage was caused to late crops of susceptible varieties. In eastern Canada infection was unusually light. Under rust-free conditions, the resistant varieties yielded about as well as the older ones. Oat stem rust and crown rust (*P. coronata*) were in most cases present only in small amounts from Manitoba eastwards.

Wheat root rot (*Helminthosporium sativum* and *Fusarium* spp.) in Manitoba caused an average estimated loss of 16·6 per cent., as compared with 7·4 per cent. in 1939. In Alberta and Saskatchewan the disease was about as prevalent as usual, but infection was less severe.

Wheat kernel smudge [ibid., xvii, p. 448], due chiefly to species of *Alternaria*, was more prevalent than usual in the Prairie Provinces; the condition caused the de-grading of 7·6 per cent. of the cars in Manitoba, 2·4 per cent. in Saskatchewan, and of 2 cars in 5,000 in Alberta.

Stalk and ear rots due to *Nigrospora sphaerica*, *Fusarium moniliforme* [*Gibberella fujikuroi*], *F. graminearum* [*G. saubinetii*], and *Diplodia zeae* were very destructive in the seed maize belt of southwestern Ontario.

Lucerne bacterial wilt (*Phytomonas insidiosa*) [*Aplanobacter insidiosum*] was widespread in the irrigated sections of southern Alberta. It was very heavy in the Brooks area, attacking stands under three years of age, and was also severe in all fields of the Grimm variety at the Experiment Station, Summerland, British Columbia. *Phytophthora cactorum* was general on sweet clover [*Melilotus*] in southern Alberta. New extensions and records of forage crop diseases included *Ascochyta imperfecta* [ibid., xviii, p. 11] on lucerne in Quebec, *Leptosphaeria pratensis* [ibid., xix, p. 102] on lucerne and *Melilotus* in Alberta, and *Stemphylium botryosum* [the conidial stage of *Pleospora herbarum*: ibid., xx, p. 306] on lucerne at Agassiz, British Columbia.

Two leaf spots of sugar beet new to Canada were found at Sidney, British Columbia, one due to *Ramularia beticola* [ibid., xiv, p. 548], the other to *Septoria betae* [ibid., x, p. 341]. *Ustilago crameri* [ibid., xviii, p. 174], rare in Canada, was observed on seed of foxtail millet [*Setaria italica*]. The first authentic case of halo blight (*Phytomonas* [*Pseudo-

*monas*] *coronafaciens* var. *purpurea*) on brome grass [*Bromus*] and timothy [*Phleum pratense*] was recorded at Morris, Manitoba [cf. ibid., xx, p. 102].

Bacterial ring rot (*Phytomonas sepedonica*) [*Bacterium sepedonicum*: loc. cit.] was found on 89 farms in the important potato-growing district of southern Alberta, though it had been present on only 40 in 1939. The disease also increased in Manitoba, Ontario, and Prince Edward Island, while a decrease was shown in Quebec and New Brunswick.

*Phytophthora infestans* destroyed at least 20 per cent. of the late potato crop in Ontario, losses being comparable to those sustained in 1928 and 1934. The disease caused some loss elsewhere in eastern Canada, but only in New Brunswick was any considerable damage sustained.

A new strain of *Cladosporium fulvum* made its appearance, to which Vetomold [ibid., xx, p. 437], a new tomato variety immune from strains 1 to 4, was susceptible. Red Currant, a variety of *Lycopersicum pimpinellifolium*, is, however, resistant to the new strain, and varieties of tomatoes possessing this resistance are to be introduced into commercial production.

New records for ornamentals include *Sclerotium tuliparum* [ibid., xix, p. 656] on bulbous iris and *Phytomonas primulae* on *Primula polyantha*, both in British Columbia.

[A French translation of the section of this report dealing with new and noteworthy diseases appears on pp. xi to xiv.]

**Plant diseases. Notes contributed by the Biological Branch.**—*Agric. Gaz. N.S.W.*, lii, 9, pp. 463–466, 483, 5 figs.; 10, pp. 536–539, 4 figs.; 11, pp. 579–581, 3 figs., 1941.

In the first of these notes on plant diseases in New South Wales it is stated that sorghum and broom millet [*Sorghum*] are both affected by kernel smut (*Sphacelotheca sorghi*) [*R.A.M.*, xx, p. 393] and head smut (*Sorosporium reilianum*) [ibid., xviii, p. 517]. The former disease may be readily controlled by seed dusting with copper carbonate, agrosan, or ceresan, at the rate of 2 oz. per bush. Besides being simple, effective, and inexpensive, the treatment also reduces loss from defective germination and seedling blight. Whenever heads infected by the latter disease are found in the field, they should be removed without scattering the spores, and burned. Crop rotation and the systematic burning of old stalks and trash (particularly after harvesting broom millet) also assist in reducing head smut to a minimum.

Mosaic was prevalent in glasshouse tomatoes, and observations showed that in the houses where the disease was widespread the persons handling the crop were heavy smokers. It is recommended that the hands should be thoroughly washed in hot soapy water before starting work in tomato houses, and that workers should refrain from smoking while handling the crop.

New records made in July, 1941, included leaf spot of azalea (*Rhododendron* sp.) caused by *Septoria azaleae* [ibid., xvii, p. 113].

In the second paper, growers in the coastal areas are advised that the first spray application against citrus black spot (*Phoma citricarpa*) [ibid., xix, p. 143], whichever of the two Bordeaux-mixture programmes

is adopted [ibid., xix, p. 69], must be given at three-quarter petal-fall, i.e., when most of the blossoms on the northern side of the trees have shed their petals, but before all the petals have fallen from the southern side.

The first cover spray for the prevention of fruit and leaf rust [*Puccinia pruni-spinosae*: ibid., xix, p. 195] in canning peach varieties on the Murrumbidgee Irrigation Area should be made about the third week in October; it should be followed by a second in mid-December. Bordeaux mixture (1½–1–80) plus ½ gal. white spraying oil should be used. Peach growers in other districts are warned against applying Bordeaux mixture to trees in leaf. The Murrumbidgee Irrigation Area is the only section of New South Wales in which copper materials can be safely applied to peach trees once growth has started.

Snapdragon [*Antirrhinum majus*] downy mildew (*Peronospora antirrhini*) [ibid., xvii, p. 686] first appeared in New South Wales about the middle of 1941.

During August, 1941, diseases recorded locally for the first time included dry rot (*Phoma lingam*) of swede turnip (*Brassica campestris* var. *napobrassica*). The same fungus was previously recorded on turnip (*B. rapa*) [cf. ibid., xvii, p. 298], and it is thought that there have been previous instances on swede turnip.

In the third paper it is stated that during recent years the weather has been so dry in the coastal areas that brown rot [*Sclerotinia fructicola*: ibid., xix, p. 227] has not been a limiting factor in the production of early apricots, but periodical rains in the spring of 1941 seemed likely to favour an epidemic in maturing crops. Growers were, accordingly, advised to pay careful attention to orchard sanitation (particularly to the removal of blighted blossoms, cankered, gummed, or wilted twigs, and dead or shrivelled fruits) and to apply a pre-maturity spray about one week before harvesting. As most of the apricot varieties grown in these 'early' districts are susceptible to 'sulphur shock', Bordeaux mixture (1½–1–80, plus ½ gal. white oil) or copper oxychloride (1 lb. per 160 gals.) is recommended at this stage. Sulphur sprays applied while these varieties are in growth are apt to cause foliage and fruit yellowing and failure of the fruit to develop further.

Under local conditions, spraying against banana leaf spot [*Cercospora musae*: ibid., xx, p. 125] gives the best results in 'good' plantations, but it also pays in many of the Tweed, Brunswick, and Richmond River areas. The profitableness of spraying would be more widely recognized than it is if it were not still possible to find a market for the poor fruits gathered from affected plants. As a rule, only four or five periods of the warm, moist weather necessary for the activity of *C. musae* occur locally each summer, and therefore it will probably be found most economical to spray at intervals of 21 days during the most dangerous period—January and February—even though this increases the number of applications from four (as given hitherto) to six. Plantations so situated that they are subject to wide fluctuations between night and day temperatures in summer, and, therefore, to frequent, prolonged dews, do not respond very satisfactorily to sprays applied at intervals of 28 days. In such plantations, it may prove necessary to spray once a fortnight during January and February, but whether this proves profitable or not will depend on the production rate

per acre. In any case, the first application should be made early in December.

Up to a few years ago the Fulghum oats variety was highly resistant to loose smut (*Ustilago avenae*) and covered smut (*U. levis*) [*U. kolleri*] in New South Wales [ibid., xiv, p. 573], but during the past three seasons it has shown considerable infection by *U. avenae*. This is attributed to the appearance of a new physiologic race of the fungus. The same variety previously behaved in an identical manner in America [ibid., ix, p. 372]. Seed treatment with formalin solution (1 lb. formalin to 40 gals. water) or with agrosan or ceresan dust (2 oz. per bush.) is recommended against both diseases.

**Report of the Waite Research Institute, South Australia, 1939–1940.**— viii+83 pp., 3 pl., 1941.

On p. 16 of this report [cf. *R.A.M.*, xix, p. 197] it is stated that in further breeding work against wheat flag smut (*Urocystis tritici*) [cf. ibid., xix, p. 169; xx, p. 354] in South Australia, most of the crossbreds had only 0 to 3 per cent. infected plants, as against 64 and 69 per cent. for Free Gallipoli and Federation, respectively. Several strains of Nabawa × Hope, Nabawa × (Riverina × Hope), Nabawa × (Nabawa × Hope), and (Gluyas × Hope) × Nabawa, which are undergoing yield trials, possess resistance to leaf rust (*Puccinia triticina* races 16 and 26), stem rust (*P. graminis tritici* race 34), mildew (*Erysiphe graminis*), and *U. tritici*.

Most crossbreds were susceptible to bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetida*]. Florence, with 12 per cent. infection, and Hope, with 4 per cent., were highly resistant, and certain Nabawa × Hope strains were partially resistant, with 30 to 40 per cent. infection, but all other varieties, including a strain of American Turkey and the durum wheats, Huguenot and Gaza, were very susceptible, with 60 to 80 per cent. bunt.

A study, begun in 1940, of the inheritance of resistance to *E. graminis* in *T[riticum] vulgare* and 28-chromosome wheats, yielded some evidence indicating a single-factor difference between Sonora (resistant) and Federation (susceptible), with dominance of resistance.

In the section dealing with plant pathology (pp. 32–35) it is stated that the climate in South Australia is probably unfavourable to any extensive development of wheat eyespot lodging (*Cercosporella herpotrichioides*) [ibid., xix, p. 465], and the disease may have been present for some time without attracting attention. There is no reason to suppose that it is of recent introduction.

Five years' observations on an area where, in 1935, wheat was badly affected by take-all [*Ophiobolus graminis*: ibid., xix, p. 522], and which was cropped continuously, showed that in this soil the disease virtually died out after four years, in spite of the continuous cropping. Superphosphate dressings were important in reducing the amount of disease present, their effect being cumulative. Tilth had a variable effect on incidence, sulphate of ammonia no effect, and varietal response was slight, but in some cases significant.

Investigations into rind blemish in oranges, associated with various fungi, including species of *Colletotrichum*, *Septoria*, and *Alternaria*, confirmed the extensive occurrence of so-called 'latent' infection of

apparently sound oranges, and showed that the fruits may be infected quite early in their development on the tree. The degree of infection varies greatly in different districts and seasons. Infection was considerably reduced by spray treatments. A tomato bacterial wilt new to South Australia was ascertained to be caused by an organism resembling *Aplanobacter michiganense*, but no cankering was observed, and the principal region involved was the xylem.

Field observations and inoculation tests suggested that the parasitic ability of *Diplodia pinea* [ibid., xx, p. 340] is only limited.

Many light soils in South Australia show mineral deficiencies. The most important appears to be copper, though in some instances zinc is also important. Boron and manganese deficiencies have also been found. Copper deficiency symptoms were experimentally produced in wheat, oats, rye, peas, Wimmera rye grass [? *Lolium perenne*], *Phalaris*, flax, tomato, subterranean clover, and lucerne grown in nutrient solutions [cf. ibid., xxi, p. 92]. In detailed studies on oats, copper deficiency symptoms developed in all the plants growing in solutions containing 0·01 mg. of copper or less per l., and no ears were produced by any of these plants. The first symptoms appeared in the copper-free cultures about five to six weeks after setting the seed to germinate. With 0·02 mg. of copper per l. the only sign of copper deficiency was decreased grain yield. Symptoms of zinc deficiency in oats developed at concentrations up to 0·02 mg. of zinc per l., while growth increased progressively as the amount of zinc was increased from zero to this amount. In other tests, the yield of grain of oats grown under conditions of molybdenum deficiency [ibid., xx, p. 56] was only one-third that of plants receiving adequate traces of this element, while the grain consisted entirely of empty husks. No experimental evidence was obtained that cobalt is of importance in plant nutrition. The amounts of copper found in whole oat plants growing on normal soils varied over a relatively narrow range and averaged 2·5 mg. per kg. The manganese content was more variable. In another series of water cultures, marsh spot of peas [ibid., xix, p. 323] was reproduced by controlling the amount of manganese.

In pot experiments with soil from McLaren Flat, where prune trees show 'little leaf' disease, the growing of indicator plants (oats, broad beans, sunflowers, and turnips) showed clearly deficiencies in boron and manganese. In field tests, boron deficiency was confirmed with broad beans.

At Robe, where lucerne gave satisfactory yields with the assistance of copper dressings, results were much improved by the addition of zinc [ibid., xxi, p. 92]. In experimental areas where pasture legumes had failed even with heavy dressings of copper, remarkable growth of barrel medick [*Medicago* sp.] resulted when both zinc and copper were applied. The resistance to copper deficiency of Rotenburger black oats was confirmed.

WIEHE (P. O.). **Division of plant pathology.**—*Rep. Dep. Agric. Mauritius, 1940*, pp. 11–13, 1941.

In this report [cf. *R.A.M.*, xx, p. 291] on plant disease work in Mauritius in 1940 it is stated that towards the end of the year several

cases of red rot (*Colletotrichum falcatum*) of sugar-cane were observed on the popular new seedling M. 134/32. The available evidence indicates that canes planted early in the season are more susceptible than those planted later. The disease is widespread, particularly in southern areas, but the percentage infection is small.

Tobacco black shank [*Phytophthora parasitica* var. *nicotianae*: ibid., xix, p. 261] was prevalent in fields and nurseries early in the season, particularly in the vicinity of the Black River. The number of plantations affected in the entire island amounted to 13 per cent. of the total, as against 25 per cent. in 1939.

Investigations on the control and spread of the wilt of *Calophyllum inophyllum* var. *tacamaha* caused by a species of *Haplographium* [ibid., xx, p. 291] were continued.

New records included *Corticium salmonicolor* on apple, *Cassia*, and poplar, foot rot of *Dendrobium* spp., due to a species of *Pythium*, mosaic of lily (*Lilium candidum*), and dahlia leaf spot (*Entyloma dahliae*).

**Botany.**—*Rep. Ga Exp. Sta., 1940–41*, pp. 102–107, 1941.

The following are among the items of interest in this report [cf. *R.A.M.*, xix, p. 450], besides those already noticed from other sources. In connexion with a project for the development of resistance in [chilli] pepper to *Sclerotium rolfsii* [ibid., xviii, p. 80], three selected strains of the Perfection variety were set in the field in three-row blocks with an unselected (control) strain in the centre row of each. The inoculation of each plant with a culture of the pathogen resulted in the development of 100 per cent. infection. Six weeks later all the unselected plants and all those of one selected lot were dead, while 10 per cent. of the other two selected lots had recovered and were making normal growth. The eight best plants from these two lots were self-pollinated and seed produced for further trials.

Tests of dusting materials for the control of groundnut leaf spot [*Cercospora arachidicola* and *C. personata*] are still in progress [ibid., xix, p. 450]; two copper-containing preparations gave promising results in preliminary trials. The average increase in yield from three applications of sulphur dust at fortnightly intervals in various localities of the State amounted in 1940 to 301·1 lb. per acre, the corresponding figures for 1937, 1938, and 1939 being 263·5, 343·4, and 410·1 lb., respectively, and the average for the entire four-year period covered by the experiments 329·5 lb.

The results of greenhouse and field tests have shown that tomato seeds infected by the agent of *Macrosporium* blight and stem canker [*Alternaria solani*: loc. cit.] become free of viable spores 11 to 12 months after harvest, provided no subsequent attack is made, so that the normal second-season planting about 20 months from the date of the first harvest may be regarded as safe from this point of view. Good control of the fungus was obtained by dusting the seed with new improved ceresan or new improved samesan jr., leaving the seed covered for at least a day.

None of the 433 different lots of seed of Austrian Winter and other field peas tested during the past five years for their reaction to leaf

spot and black stem (*Mycosphaerella pinodes* and *Ascochyta pinodella*), leaf blotch (*Septoria pisi*), powdery mildew (*Erysiphe polygoni*), and root rot (largely *Aphanomyces euteiches*) [ibid., xx, p. 211] showed a higher degree of resistance to the diseases in question than Austrian Winter, and most were much more susceptible, the same being true of the progeny of 280 crosses between the best plants of the various lots.

**Plant pathology and physiology.**—*Rep. Tex. agric. Exp. Sta., 1940*, pp. 83–91, 1941.

This report [cf. *R.A.M.*, xx, p. 195] contains, *inter alia*, the following items of interest. In further work by W. N. Ezekiel on cotton root rot, a strain of *Phymatotrichum omnivorum* kept in culture for 11 years has retained its original characteristics, including abundant production of sclerotia. The disease was observed for the first time (by W. N. Ezekiel and C. H. Rogers) on young plants of *Albizzia julibrissin* and *Prunus virens*. Studies by L. M. Blank [cf. ibid., xx, p. 403] showed that nitrogenous fertilizers significantly reduced the incidence of the disease on four early and four late cotton varieties and gave highly significant increases in yield. Phosphate fertilizers exercised no significant effect when applied to Houston black clay, but on less calcareous soils significantly increased both percentage disease and yield. When soil sulphur was applied in the furrow at the rate of 2,000 lb. per acre on infested fields in November and March, no control resulted but similar applications of a mixture of soil sulphur and manure (1 to 3) in March resulted in a slight reduction in root rot damage.

Investigations by P. J. Talley and L. M. Blank showed that the utilization of nitrate nitrogen by *P. omnivorum* [ibid., xxi, p. 75] sets up a drift towards a more alkaline reaction and does not, as a rule, retard growth. It was demonstrated that ammonium nitrogen and nitrate nitrogen are essentially of equal value in the nutrition of *P. omnivorum* when a favourable $P_H$ is maintained.

A. L. Harrison states that, as in previous years, wilt (*Fusarium* [*bulbigenum* var.] *lycopersici*) was one of the most serious diseases of tomato during 1940 in the Yoakum-Hallettsville area of Texas. In several fields even the wilt-resistant Marglobe variety showed 90 to 100 per cent. infection. The severity of the disease was not affected by varying fertilizer dressings. In tests with insoluble copper materials on plants free from leaf diseases Tennessee No. 34, tribasic copper sulphate, copper hydro 40, basic copper sulphate, and cuprocide gave yields comparable to those of the controls, whereas Bordeaux mixture (4–4–50) appreciably reduced yields.

G. E. Altstatt found that 5 to 15 drops of benzol, carbon bisulphide, carbon tetrachloride, formaldehyde, and toluol, placed so that the liquid did not touch the sclerotia, were lethal to *Sclerotium rolfsii* (in stoppered test-tubes) after 17 hours. One drop and three drops of chloropicrin were lethal after 2½ hours and 30 minutes, respectively. When the sclerotia were exposed to confined vapours from measured quantities of chloropicrin, up to 3 c.c. per l., viability was reduced, though some sclerotia germinated after 25 hours' exposure. Phenyl mercury nitrate (phe-mer-nite) diluted with water (1 in 10,000) was lethal to the sclerotia after immersions of 60 seconds. An aqueous

solution of 1 in 10,000 of sodium ethyl mercury thiosalicylate (merthiolate) reduced viability from 100 to 15 per cent. in three minutes, while five minutes' immersion in a 1 in 1,000 aqueous solution was lethal.

On p. 147 of this report, E. W. Lyle states that sulphur-copper mixtures gave better control of rose black spot [*Diplocarpon rosae*: ibid., xix, pp. 540, 656] than plain sulphur. Satisfactory control again resulted when fungicidal applications were deferred until symptoms developed. With 18 applications of 90 per cent. sulphur plus 10 per cent. cuprocide GA dust mixture, infection was reduced in a planting of 164 hybrid tea roses of different varieties from an average of four infected leaflets per plant on 16th April to 1·1 on 20th October.

E. C. Tullis (p. 163) states that the commonest rice diseases were *Helminthosporium oryzae* [*Ophiobolus miyabeanus*], *Piricularia oryzae*, *Cercospora oryzae* (rotten neck), and *Tilletia horrida* (kernel smut) [cf. ibid., xx, p. 423]. *O. oryzinus* [loc. cit.] was also found on rice at the Experiment Station; it has not yet been observed in commercial rice fields in Texas. At the Station, leaf spot due to *C. oryzae* was less severe on plants from sowings made on 10th June than on plants from sowings made on 20th March.

C. E. Minarik states that in field experiments fertilization with sodium nitrate and ammonium sulphate failed to induce 'straighthead' in rice [ibid., xx, p. 222].

When Early Prolific rice was grown in gravel culture and nutrient solutions containing all possible concentrations of magnesium and calcium were applied to the surface of the gravel, the number of plants with 'white tip' [ibid., xix, p. 493] decreased with increasing concentrations of calcium, whatever the magnesium content of the solution. Calcium toxicity symptoms were produced by 250 p.p.m. of calcium with concentrations of magnesium of 5 p.p.m. and under. When Blue Rose and Early Prolific rice were grown in solution culture with low calcium and varying magnesium concentrations, white tip severity increased with increasing magnesium concentrations.

On p. 245 G. H. Godfrey states that at least four types of citrus gummosis are present in the Lower Rio Grande Valley: (1) a physiological form, not very injurious; (2) a mild form due to *Diplodia natalensis*; (3) an active, foaming type caused by sap fermenting organisms, infectious and transmissible, but not penetrating beyond the cambium layer and not spreading extensively; and (4) an internal wood rot caused by an undetermined, actively parasitic sapwood-invading fungus, which spreads in long, broad streaks into the wood of the trunk and branches, the advancing edge of the infected area having a characteristic pink colour. Type 2 was readily controlled by removing protruding wood to expedite healing-over of the wound, and the application of a wound dressing. Type 3 was rapidly and permanently arrested by cutting the bark to expose the discoloured cambium, and applying a disinfectant and a wound dressing. One tree affected by type 4 was apparently cured by removing all discoloured wood (with a $\frac{1}{4}$ in. safety margin), and applying carbolineum followed by 50–50 asphaltum-carbolineum plus 2 per cent. phenol.

S. S. Ivanoff (p. 273) states that selections of spinach plants for resistance to white rust (*Albugo* [*Cystopus*] *occidentalis*) [ibid., xix, p. 4]

are being made. The disease is so severe in the Winter Garden area that it may seriously threaten the existence of the spinach-growing industry. Hundreds of acres have had to be left uncut owing to infection. Secondary spread occurs by means of irrigation flood water. Circumstantial evidence suggests that the spores may be borne by the wind from diseased to healthy fields several miles away. Abundant infection is present in fields planted to spinach for the first time. The incubation period is about 12 days at about 70° F. and relative humidity of about 80 per cent. The sporangia germinate in free water in under 24 hours at 70°.

Guarch (A. M.). **Comunicaciones fitopatológicas.** [Phytopathological notes.]—Reprinted from *Rev. Fac. Agron. Univ., Montevideo, 1941*, 23, 12 pp., 5 figs., 1941.

Two years previously to the time of writing, *Scolecotrichum graminis* [*R.A.M.*, xviii, p. 587] and its variety *brachypoda* were widespread in Uruguay, the former on *Dactylis glomerata* and the latter on rye and *Bromus unioloides*. The variety is described by Spegazzini in 'Micetes Argentinenses' as differing from the type in the freedom from constriction at the single conidial septum. The conidia in the author's material were light olivaceous, smooth, fusoid, clavate, 32 to 34·5 by 10 to 12·5 $\mu$, and were borne on grey-olivaceous, fasciculate, erect conidiophores, 37 by 6·5 $\mu$. The lesions produced by *S. graminis* var. *brachypoda* on rye leaves measured 3 to 8 cm. by 2 mm. and caused a pale grey or whitish discoloration of the foliar tissue. The conidia of *S. graminis* proper measured 33·3 by 9·9 $\mu$ and were constricted at the septum, the conidiophores being 93 $\mu$ in length.

*Cercospora medicaginis*, the agent of a chestnut, yellow- or whitish-bordered leaf spot of spotted bur clover (*Medicago arabica*) [cf. ibid., xviii, p. 397], was observed, for the first time in Uruguay, at the University of Montevideo in 1938, and has since been encountered in several departments of the interior, where the host is of considerable importance as a forage crop. The pathogen has been shown by E. F. Hopkins (*Phytopathology*, xi, pp. 311–318, 1921) to be perpetuated from one year to the next by means of the seed, local samples of which also bore dark spots on the surface.

*Puccinia anomala* was detected in the teleuto stage on a new host for Uruguay, *Hordeum murinum* subsp. *leporinum*, in the environs of Montevideo, where intensive infection is favoured by the extreme humidity of the climate.

*P. arachidis* [*R.A.M.*, xix, p. 261], first observed on groundnut in Paraguay by Spegazzini, has been found in Uruguay (in the teleuto stage only) on a native species, *Arachis marginata*, in company with *Ascochyta* sp., on the Brazilian frontier. The same rust was collected in 1936 on various species of *Arachis* by A. Archer in Brazil (also close to the frontier).

*Helminthosporium ravenelii* is prevalent throughout Uruguay on *Sporobolus berteroanus* [ibid., x, p. 463], and has also been reported from Australia, the United States, Brazil, and the Argentine Republic.

Apples are affected by *Physalospora malorum* [*P. obtusa*] and soft scald, the latter observed for the first time on stored Jonathans.

For the past two years, *Septoria gladioli* has occurred in a destructive form in the University gladiolus plantings, where the pycnidial stage of the fungus on the leaves has been effectively held in check by spraying with 1 to 1·5 per cent. Bordeaux mixture. In the field, however, it is advisable to practise crop rotation and to disinfect the corms by two hours' immersion in 0·25 per cent. uspulun [ibid., xx, p. 20].

*Pestalozzia molleriana* Thüm. attacks the leaves of *Eucalyptus obliqua*, forming oblong or circular, pale chestnut spots, 1 to 2 cm. in diameter, with red wine-coloured margins; the fungus, which is characterized by quadriseptate, fusiform spores, 22 by 6 $\mu$, the three median cells dark olivaceous and the basal and apical ones hyaline, was found to be causing considerable damage to young trees at the University in 1940.

Riker (A. J.), Lyneis (Mary M.), & Locke (S. B.). **Comparative physiology of crown gall, attenuated crown gall, radiobacter, and hairy root bacteria.**—*Phytopathology*, xxxi, 11, pp. 964–977, 1 fig., 2 graphs, 1941.

In the writers' comparative studies at the Wisconsin Agricultural Experiment Station on the physiological characters of one pathogenic and one attenuated strain of *Phytomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xx, p. 248], *Bacillus* [*Bact.*] *radiobacter*, and *P.* [*Bact.*] *rhizogenes*, all these organisms except the last-named, which is unable to develop on inorganic sources of nitrogen, behaved similarly to one another in respect of their utilization of various sources of nitrogen and carbon, and carbon dioxide and hydrogen sulphide production, the temperature at which the pathogenic strain of *Bact. tumefaciens* was incubated, i.e., above or below the critical point for gall formation on the tomato (28° to 30° C.), making no difference. *Bact. rhizogenes*, unlike *Bact. tumefaciens*, evolved acid from glucose. The results of serological experiments suggest that pathogenicity in crown gall is independent of any factor associated with agglutinin. Above and below the critical temperature, minor fluctuations in the osmotic pressure of tomato extract were produced by both the virulent and attenuated strains of *Bact. tumefaciens*, and in a sugar medium both lowered the osmotic pressure. Temperatures above and below the critical point likewise permitted good growth of *Bact. tumefaciens* in inoculated tomato tissue, but no galls were formed either on this host, *Sedum*, or *Bryophyllum* above 28°, though they developed at 31° on tobacco, *Nicotiana glutinosa*, and a hybrid between these two species.

Ark (P. A.). **Chemical eradication of crown gall on Almond trees.**—*Phytopathology*, xxxi, 10, pp. 956–957, 1941.

Of the many chemicals tested during the past three years for the control of crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) on almond trees in the San Joaquin Valley, California, where the destructive character of the disease is a limiting factor in production (also of peaches), elgetol (sodium-dinitro-cresol), iodine, and clove oil gave the most effective results. The elgetol (20 vols.) was diluted with methanol (methyl alcohol) (80 vols.) and the mixture well shaken before painting on the clean gall and about ½ to 1 in. of the healthy bark. Two reliable

iodine formulae consist of: A, 50 parts methanol (methyl alcohol), 25 parts each glacial acetic acid and glycerine, and 10 parts metallic iodine; and B, 100 parts methanol, 15 parts acetic acid, and 12 parts metallic iodine. These solutions are intended for use on whole galls, and if applied to a scarified surface should be diluted with methanol five and six times, respectively. Clove oil and acetic acid (1 part each) and methanol (2) also gave very good control, but the expense of the first-named ingredient is likely to preclude its use on a large scale. Elgetol, on the other hand, is both cheap and effective: 55 galls treated from July to December, 1939, were found to be dead in May, 1940, and by the following September there had been no recurrence of infection.

BRETT (C. C.) & DILLON WESTON (W. A. R.). **Seed disinfection IV. Loss of vitality during storage of grain treated with organo-mercury seed disinfectants.**—*J. agric. Sci.*, xxxi, 4, pp. 500–517, 1 pl., 1941.

In an introductory paragraph the authors state that the disinfection of cereal seed-grain with organo-mercury dressings has become an established practice in recent years in England and Wales, as many as 260 centres being estimated to have existed in 1938, where seed treated by the seed merchants could be obtained, and the number of centres has undoubtedly increased since then. As the seed-grain may be held some months after treatment, in some cases with injury to germination, an inquiry was made into the storage conditions necessary to ensure the minimum loss of vitality.

The results of seven experiments, in which the seed-grain of wheat, oats, and barley was treated with proprietary organic mercury dusts at rates of from 2 to 10 oz. per bush. and then stored in envelopes or jute bags, confirmed previous preliminary conclusions [cf. *R.A.M.*, xix, p. 521] that seed of high initial germination, average moisture content, sound physical condition, dusted as recommended and stored under satisfactory conditions, does not lose vitality to any greater extent than untreated seed during at least one year's storage or, in some cases, longer. The application of overdoses induced a more pronounced loss of germination, especially after a year's storage. High moisture content of the seed and conditions of relatively high humidity and of fluctuating temperature during storage caused rapid loss of germination in both treated and untreated seed-grain. The loss of germination was observed to be more rapid and the phytocidal effect of the disinfectant more pronounced in wheat than in oats, and in barley least of all. This is tentatively explained by the fact that in threshed wheat the caryopsis is free from the paleae, in oats it is free from, but more or less enveloped by, the paleae, whereas in barley it is firmly united with the enclosing paleae. Storage of treated wheat seed-grain in closed containers resulted in very rapid loss of germination, whereas similarly stored untreated grain retained its vitality for well over a year. The maximum amount which could be held by well-conditioned grain varied with the different proprietary dusts. Superficially moist seed-grain retained dust at rates much in excess of those recommended and the overdoses led to retardation and reduction of germination. In addition, it is pointed out that mixing is difficult

with moist seed, and, as a result, the distribution of dust may not be even, too much dust clinging to some seeds which may fail to germinate.

LOEGERING (W. Q.). **A satisfactory medium for germination of urediospores of Puccinia graminis tritici.**—*Phytopathology*, xxxi, 10, pp. 952–953, 1941.

Particulars are given of a rapid and reliable method developed at the Federal Rust Laboratory, University Farm, St. Paul, Minnesota, for the germination of the uredospores of *Puccinia graminis tritici*. The variable results commonly obtained with the wheat rust being attributed to the use of water as a germinating medium, trials were carried out with several kinds of solid substrata, of which 1 per cent. water agar proved to be the most suitable. Ten c.c. of this substance is poured into a Syracuse dish and left to harden; then the spores are mixed in a drop or two of distilled water on a hollow-ground glass slide, and one or two loopfuls of the resultant suspension transferred to the centre of the agar medium. The dishes should be left uncovered as sufficient moisture is available for germination, which may be observed after two to three hours at room temperature. Strikingly consistent results were secured by means of this technique, the average germination being 95 per cent. Using this method, six-weeks-old uredospores showed 5 per cent. germination, whereas no sign of life could be detected in plain water.

JOHNSON (T.) & NEWTON (MARGARET). **The effect of high temperature on the stem rust resistance of Wheat varieties.**—*Canad. J. Res.*, Sect. C, xix, 11, pp. 438–445, 1 pl., 1941.

Eighteen wheat varieties resistant to stem rust (*Puccinia graminis tritici*) were tested under greenhouse conditions for their resistance to physiologic races 56, 29, and 15 at a constant low temperature of about 60° F., a constant high temperature of about 80°, and at an intermediate temperature fluctuating daily from 50° to 55° at night to 70° to 85° at noon.

At the low and at the intermediate temperature some of the varieties remained immune, while others were highly or moderately resistant. At the high temperature the following were immune or highly resistant, viz., Bokveld, Iumillo, Gaza, Red Egyptian, and N.A. 95 Egypt, while Marquillo × Waratah, Hope, Hochzucht, Minor, Bobin Gaza Bobin, and Federation × Acme were moderately resistant, and Kenya, R.L. 1373, Syria, McMurachy, Sweden, Rhodesian, Falberg, and Eureka were moderately or completely susceptible. In the field the last-named group cannot be expected to display high resistance in regions of high temperature during the rust infection period, and in fact McMurachy and Kenya are known to be less resistant at St. Paul, Minnesota, and Manhattan, Kansas, than at Winnipeg, the mean temperatures for July from 1932 to 1940 being 76·7°, 84·2° (at Topeka, 50 miles from Manhattan), and 69·7° F., respectively. According to Watson [*R.A.M.*, xx, p. 522], certain Kenya wheats were less resistant at St. Paul in 1940 than usual, and the explanation of this behaviour may lie in the high temperature (81°) there during the last 15 days of July.

VALLEGA (J.). **Razas fisiológicas de 'Puccinia triticina' procedentes de Ipanema, San Pablo, Brazil.** [Physiologic races of *Puccinia triticina* originating at Ipanema, São Paulo, Brazil.]—*Rev. argent. Agron.*, viii, 1, pp. 57–59, 1941. [English summary.]

Three distinct physiologic races of *Puccinia triticina* were isolated at the Phytotechnical Institute, Santa Catalina, from samples of wheat from São Paulo, Brazil [*R.A.M.*, xi, p. 359], viz., 19, 64, and 105, of which the two latter are well known in the Argentine [ibid., xiii, p. 619; xx, p. 9], whereas the first named has not hitherto been reported from South America. Race 19 occurred on the Litoral and Klein 32 and 33 varieties, 64 on Centenario, Riosulina, Litoral, Porvenir, Klein 32, and 38 M.A., and 105 on Klein 33 only.

BAMBERG (R. H.). **Fall-sown spring Wheat susceptible to dwarf bunt.**—*Phytopathology*, xxxi, 10, pp. 951–952, 1941.

In 1940, winter wheat in the northern part of the Gallatin Valley, near Bozeman, Montana, was severely attacked by dwarf bunt (*Tilletia tritici*) [*T. caries*: *R.A.M.*, xiv, p. 350; xx, p. 518], a few fields showing 35 per cent. infection, with areas about ½ acre in extent in which over 90 per cent. of the heads were smutted. Infection was most severe on plants grown from seed treated with copper carbonate or new improved ceresan, the failure of which to control the disease points to the use of resistant varieties as a more reliable method. Spring-sown wheat appears to be immune from dwarf bunt under natural conditions. In the autumn of 1939, bunt-free seed of six spring and 75 winter varieties was sown in parts of two fields in which the disease had occurred in the previous crop, and in comparative counts at the end of the winter the average percentages of infection in the spring varieties in three replications were as follows: Pilot 4, Marquis and Ceres 18, Reward 22, Thatcher 24, and Reliance 29, the corresponding figures for six winter ones being 7 for Turkey, 11 for Yogo, 17 for Hybrid 128, 23 for Montana 36, 28 for Karmont, and 41 for Kharkof. It is apparent from these data that the normal resistance of spring wheats to dwarf bunt is not necessarily maintained under autumn sowing conditions.

GARRETT (S. D.). **Soil conditions and the take-all disease of Wheat. VII. Survival of Ophiobolus graminis on the roots of different grasses.**—*Ann. appl. Biol.*, xxviii, 4, pp. 325–332, 1941.

In continued studies on the take-all disease of wheat (*Ophiobolus graminis*) [*R.A.M.*, xx, p. 250], 16 species of grasses were inoculated with the take-all organism and their roots examined under the binocular dissecting microscope for runner hyphae and discolouring disease lesions. Some species were found susceptible and others fairly resistant, while yet other species were difficult to classify in either category. In a different test, the seed of these grass species was sown in a light-textured soil in wooden boxes over a minimal amount of inoculum, the grass tops cut off two months later, and test wheat seedlings planted in the inverted sods to be examined at approximately monthly intervals. The fungus was found to survive in all 16 species to some extent compared with a negligible survival in fallow soil or under clover, but there were notable differences in its longevity under different grasses. The

resistance of *Phleum pratense* was confirmed, and for use on heavily infected land seeds mixtures of this grass and *Avena elatior* [*Arrhenatherum avenaceum*] in place of *Lolium* spp. are suggested.

WALKER (A. G.). **The colonization of buried Wheat straw by soil fungi, with special reference to Fusarium culmorum.**—*Ann. appl. Biol.*, xxviii, 4, pp. 333–350, 11 graphs, 1941.

With the object of studying the colonization by fungi of wheat remains in the soil [*R.A.M.*, xix, p. 11], 1 in. lengths of sterilized straw were buried in the experimental soils in 3½ in. pots, incubated at 16° to 20° C., and after requisite periods washed out of the soil, surface-sterilized with mercuric chloride or other disinfectant, and plated out on acidified potato dextrose agar with a $P_H$ value of 5·0. Various groups of organisms, of which *Fusarium culmorum* and *Penicillium* spp. were numerically the most important (at least during the first five months of incubation in the soil), appeared generally to be present in the decomposing straw, but the method of surface sterilization employed apparently decided which organism produced a colony on the isolation plate. When mild sterilizing agents, such as calcium hypochlorite, were used, *Penicillium* spp. were crowded out by the vigorous growth of *F. culmorum*, which grew best of all from straw merely washed in sterile water. On the other hand, *F. culmorum* showed little resistance to the more drastic sterilizing agents such as mercuric chloride and silver nitrate, of which *Penicillium* spp. were very tolerant and after longer periods of treatment remained often the only organisms developing on the plates. The saprophytic isolates of *F. culmorum* from buried wheat straw proved to be just as pathogenic to wheat seedlings as those isolated from diseased plants. It is pointed out that straw invaded by *F. culmorum* as a saprophyte represents potential centres of infection as well as a means of perpetuation of the organism in the soil.

NICOLAISEN (W.) & LEITZKE (B.). **Gefässversuche über die Eignung verschiedener Produkte der Kupferindustrie zur Bekämpfung der Heidemoorkrankheit (Urbarmachungskrankheit).** [Pot experiments on the adaptability of various products of the copper industry to the control of the heath marsh disease (reclamation disease).]—*Pflanzenbau*, xvii, pp. 263–293, 1941. [Abs. in *Chem. Zbl.*, cxii (ii), 10, p. 1315, 1941.]

In pot experiments at the Institute of Fodder Cultivation, Kiel, the effect of various copper products on oats, lupins, and mustard was compared with that of copper sulphate in the control of reclamation disease [*R.A.M.*, xxi, p. 11]. Satisfactory results were obtained with slag from the North German Refinery and waste slag from the Duisburg Copper Works, whereas round oven slag was less effective, presumably owing to its insufficient degree of fineness. Besides the copper content of the residues, the nature of the compounds involved plays an important part in their utility for the purpose under discussion. The outcome of most of these tests was encouraging.

HYNES (H. J.). **The artificial production of ergot.**—*Pharm. J.*, cxlvii (4th Ser., xciii), 4072, p. 172, 1941.

Following representations from the British Government for supplies

of ergot [*Claviceps purpurea*], cultures were prepared by the Department of Agriculture, New South Wales, and despatched to 28 growers in widely separated parts of the State. Tests were made to find the most suitable means of propagating the fungus in bulk [*R.A.M.*, xxi, p. 70], including the use of rye grain, oats, and rye plus oats, in quart bottles (300 ml. grain per bottle), to which different quantities of water were added, with and without calcium carbonate. Pre-soaking was also tested. All the bottles were plugged with cotton wool, autoclaved for one hour at 15 lb., and inoculated from agar cultures by needle transfers. They were then vigorously pounded on a rubber cork to ensure adequate mixing of the spores with the grain. After incubation at 23° to 25° C. for three to four weeks without further shaking, it became evident that the best fungal growth had occurred on rye to which 300 ml. water had been added before sterilization. The addition of calcium carbonate made no difference. When the fungus-permeated medium was removed, shaken in water, and the liquid strained through a knapsack spray sieve (30 meshes to the linear inch), the suspension teemed with conidia. When the cultures were required, the material was removed from the bottles and despatched in cardboard cartons. It had to be used promptly, as when stored for a week or so it became contaminated with common moulds.

Growers were directed to store the cartons in a cool place and inoculate when the rye was breaking into flower. One carton of culture (1 qt.) used with 80 to 100 gals. water sufficed for one acre of rye. Some 200 acres were treated; yields of ergot were low ($\frac{1}{2}$ to 20 lb. per acre) owing to dry weather. Spraying in misty weather was found to be advantageous. Growers were informed that mature ergots could be collected by hand at grain maturity or with the grain at harvesting and threshing, subsequently being floated off in 20 per cent. brine solution, rinsed, and dried.

In a test at the Biological Glasshouses in which black winter rye was sown in a plot of 316 sq. ft. in May, 1940, and inoculated four times at intervals of 10 days, beginning when the first spikelets flowered, the yield amounted to 14 oz., representing 121$\frac{1}{2}$ lb. per acre. Preliminary pot tests in the glasshouse indicated that the best time for inoculation was during the early flowering period.

It is concluded that ergots of high quality can be produced artificially in New South Wales, but the main limiting factor to success on a commercial scale is the uncertainty of the weather conditions when the rye comes into flower. Only in the cooler, moister localities can the project be considered.

[The information given in this paper also appears in *Agric. Gaz. N.S.W.*, lii, 11, pp. 571–573, 581, 4 figs., 1941.]

Melville (R.). **Ergot cultivation.**—*Pharm. J.*, cxlvii (4th Ser. xciii), 4073, p. 178, 1941.

With reference to Hynes's investigations carried out in New South Wales on the commercial production of ergot [*Claviceps purpurea*: see preceding abstract], the author points out that, for the project to be successful in Britain, cool, humid conditions during the flowering period of the rye are also necessary. The culture of the conidial stage of the

fungus on rye grains in quart bottles appears to be the most practicable method of providing inoculum. Large stocks of such cultures can be prepared and kept in cold storage, the conidia retaining their vitality for long periods at 0° to 4° C. Inoculations are best made in the early flowering stage, when a large proportion of the glumes are open, and the anthers are exserted. If more than one is made, they should be carried out at two-day intervals. Other biological features of the rye plant should be turned to account. Thus, in some varieties many of the flowers in a spike open simultaneously, while in others flowering is successional and is spread over a longer period; stroking or brushing the ears induces the glumes to open.

Cultures should be started from individual ergots with a rich alkaloid content, which can be assayed micro-chemically [cf. *R.A.M.*, xix, p. 273]. The injection inoculation method deserves a trial. Direct injection of spores into the young ears before the glumes open would probably give more uniform infection under differing climatic conditions than does spraying. Ergot cultivation should be attempted only where the climate is sufficiently humid.

LEVITT (E. C.) & NICHOLSON (R. I.). **Severe manganese deficiency of Citrus.**—*Agric. Gaz. N.S.W.*, lii, 9, pp. 477–479, 4 figs., 1941.

In 1938, a late Valencia orange tree growing at Glenorie, New South Wales, was observed to show severe symptoms of manganese deficiency [*R.A.M.*, xix, pp. 338, 644]. Stunted, small, and bushy, it tended to produce occasional strong S-shaped growths. The foliage was a yellow greenish-grey. No gumming was present. Many short twigs were produced, and defoliated twigs were common. The leaves were mostly small, rounded, and dorsally curved. On mature leaves the veins on the dorsal surface were raised. Abscission of the immature leaves frequently took place progressively from the base of the new growth, occasionally causing complete defoliation, but the terminal three or four leaves generally remained attached, giving the shoots a tufted appearance. During the first four years after planting, the tree failed to crop, though blossom production was profuse. The manganese content of sample leaves was found to be only 4·4 p.p.m. dry weight, as against 10·7 p.p.m. for the leaves of adjacent trees showing the usual manganese deficiency mottle.

On 16th January and 8th October, 1940, half the tree was sprayed with a mixture made up of 4 lb. manganese sulphate, 2 lb. hydrated lime, and 80 gals. water, plus agral II spreader. The treated side grew normally and set a heavy crop, while the untreated half bore a light crop of small fruits. Analyses showed the sprayed leaves to have a manganese content of 81·9 p.p.m., as against 3·2 p.p.m. for the unsprayed.

The extreme symptoms shown by this tree are attributed to the alkaline effect on the soil of ashes resulting from the burning of orange trees on the same site two years before the tree was planted.

DE FLUITER (H. J.). **Over het voorkomen van de grijze Dadapschimmel op Koffie.** [On the occurrence of the grey Dadap fungus on Coffee.] —*Bergcultures*, xv, 42, p. 1441, 1 fig., 1941.

At the Besoeki (Java) Experiment Station, *Septobasidium bogoriense*

[*R.A.M.*, x, p. 557], the so-called 'grey dadap fungus', has been found parasitizing scale insects (*Ischnaspis longirostris*) and green aphids (*Coccus viride*) on coffee branches and 'cherries', almost completely investing them with a grey crust.

MITCHELL (R. B.), ADAMS (J. E.), & THOM (C.). **Microbial responses to organic amendments in Houston black clay.**—*J. agric. Res.*, lxiii, 9, pp. 527–534, 7 graphs, 1941.

As a background for studies on the control of cotton root rot (*Phymatotrichum omnivorum*) [*R.A.M.*, xx, p. 301] investigations were undertaken on the soil microbiology of Houston black clay, the soil type chiefly infected with the cotton root-rot organism in Texas. It was found that the highest microbial activity occurred during a period beginning in March and ending in early June. The temperatures ranged above 70° F. from March to November and from 80° to 90° from June to October, while from early December to February they remained below those required for active microbial multiplication. The highest counts for bacteria, fungi, and Actinomycetes were made on soils receiving organic residues [ibid., xvi, p. 672].

MITCHELL (R. B.), HOOTON (D. R.), & CLARK (F. E.). **Soil bacteriological studies on the control of the Phymatotrichum root rot of Cotton.**—*J. agric. Res.*, lxiii, 9, pp. 535–547, 2 figs., 1941.

In experiments on the control of cotton root rot (*Phymatotrichum omnivorum*) [see preceding abstract] the fungus was observed to develop quickly and show little subsequent disintegration during 16 days when inoculated into quart jars half-filled with Hunt clay to which no organic material was added or only superphosphate, whereas in the presence of 3 per cent. farmyard manure or 3 per cent. chopped sorghum fodder in the soil, it either failed to grow or showed initial growth followed by disintegration. In similar experiments cotton seed meal and hulls and chopped cotton roots were likewise found to inhibit the growth of the fungus. In the field, cotton roots injured by clipping or girdling in late summer or early spring showed pronounced increases in micro-populations. Mycelium of *P. omnivorum* developed freely in Erlenmeyer flasks containing cotton roots in all stages of decomposition, sterilized to remove all competitive microbial activity and then inoculated with *P. omnivorum* alone, while it failed to grow in the unsterilized flasks, indicating that the survival of the fungus is limited by microbial interrelationships rather than by food exhaustion. In laboratory experiments only 19·6 per cent. of the sclerotia of *P. omnivorum* failed to survive when buried in soil receiving no organic residue, 14·4 per cent. in soil amended with superphosphate, while in soils amended with farmyard manure or chopped sorghum fodder, 64·9 and 69·7 per cent., respectively, were eliminated. Major reductions in sclerotial numbers were secured only during the periods of intensive microbial activity. Sclerotia surviving the period of increased microbial activity occasioned by fertilization persisted with little further reduction in numbers for several months. In Cholodny slide studies, it was observed in the early stages of incubation that viable young sclerotia disappeared from amended soils more rapidly than sclerotia killed by heat; the latter disappeared from amended soils in greater numbers than from unamended

ones. The application of either farmyard manure or sorghum fodder in the field by incorporating them into the upper 8 to 10 in. of soil by rotary ploughing in October, resulted in increased microbial activity, reduced incidence of dead cotton in the succeeding crop, and greater difficulty in the recovery of sclerotia from the amended levels in field soil.

GOTTLIEB (M.) & BROWN (J. G.). **Sclerotium rolfsii on Cotton in Arizona.**—*Phytopathology*, xxxi, 10, pp. 944–946, 1 fig., 1941.

In addition to the recognized symptoms, the Arizona strain of *Sclerotium rolfsii*, which has caused such heavy damage to the cotton crop in the Salt River Valley and elsewhere during the past few years [*R.A.M.*, xx, p. 393], was found to be responsible for a swelling of the main stems near the soil-line, apparently a sequel to seedling infection. The fungus was most prevalent in nematode-infested soils, but was also present in fields free from the agent of root knot; it spread in a somewhat sporadic fashion following irrigations and summer rains throughout the growing season. About 16th December, a month after a killing frost, *S. rolfsii* showed much activity in these infested fields. Of great significance in relation to the perpetuation of infection is the detection of an abundance of inoculum on the decaying, ploughed-under stalks of the preceding cotton crop in fields showing no dying plants. The pathogen was first observed in Arizona in 1936 on larkspurs [*Delphinium*: ibid., xvii, p. 504] and subsequently appeared on sugar beets [loc. cit.] about 150 miles distant from the site of the first outbreak; it was next observed on the latter crop some 15 miles east of the affected cotton fields, to which, however, the manner of transmission remains for the present obscure. Mature cotton plants sustained exceptionally heavy damage from southern sclerotial rot in the epidemics under investigation, whereas Ezekiel and Taubenhaus [ibid., xi, p. 298] found only one dying from the effects of the disease, while their inoculation experiments of mature plants failed.

ALDERSON (V. G.) & MASON (LUCILE R.). **Powdery mildews as allergens.** —*Calif. West. Med.*, lv, 5, pp. 241–243, 6 figs., 1941.

At the Oakland Clinics, California, in the spring of 1939, 65 out of 100 pollen-sensitive patients reacted positively to tests with spore extracts in Coca's solution of *Microsphaera alni* from valley oak (*Quercus lobata*) leaves on the Mills College campus. It is thought highly probable that the powdery mildews, which number at least 2,000 hosts, are the agents of many perplexing cases of allergy.

LUDLAM (G. B.) & HENDERSON (J. L.). **Neonatal thrush in a maternity hospital.**—*Lancet*, cclxii (i), 6177, pp. 64–70, 4 figs., 2 graphs, 1942.

This is a very comprehensive study on the incidence of thrush (*Monilia* [*Candida*] *albicans*) in an Edinburgh maternity hospital, accompanied by considerations on the sources of infection, the factors affecting the disease, and its prophylaxis. The fungus, which was present, at a conservative estimate, in 6·4 per cent. of a special series of infants [*R.A.M.*, vi, p. 33 *et passim*] observed between the second and tenth days of life in 1940, was identified by means of its morphological and cultural characters on Sabouraud's agar, its sugar reactions, and

agglutination tests with a specific serum. In connexion with the last-named criterion it is mentioned that a considerable amount of cross-agglutination with allied species took place, *M. candida* [*C. vulgaris*], for instance, agglutinating to the same end point as *C. albicans*, though not quite so strongly. In addition to the 163 cases comprising the special series, the mouths of 11 out of 60 unselected infants yielded *C. albicans*, which was further isolated from the throat swabs of 20 out of 60 nurses, and from the fingers of 3 out of 42.

POLAYES (S. H.) & EMMONS (C. W.). **Final report of the identification of the organism of the previously reported case of subacute endocarditis and systemic mycosis (Monilia).**—*J. Amer. med. Ass.*, cxvii, 18, pp. 1533–1534, 1 fig., 1941.

The fungus isolated from the first case of subacute endocarditis and systemic mycosis to have been clinically diagnosed and published [*R.A.M.*, xx, p. 164] formed on Sabouraud's agar budding ovoid bodies, 4 $\mu$ in diameter, with very sparse hyphae, and on maize meal agar similar budding elements, 3 to 4 $\mu$ in diameter, with delicate, short, freely branching but scantily budding submerged hyphae. On acid dextrose agar after ten days at 30° C. the colonies were ivory to yellow, glistening, with smooth or slightly scalloped margins, while those of the same age on blood agar at 37·5° were grey, smooth, glistening, non-haemolytic, low dome-shaped, with even edges 2 to 3 mm. in diameter. Acid and gas were produced in dextrose and levulose broths. The organism was identified as *Candida parakrusei*.

LUBCHENKO (A. E.). **Mycotic infection in northeastern Colorado. Epidermophyton of animal origin.**—*Rocky Mtn med. J.*, xxxviii, 11, pp. 862–867, 14 figs., 1941.

Epidermophytosis of animal origin, in contradistinction to trichophytosis from the same source [*R.A.M.*, xx, p. 17], is stated to be very rare in north-eastern Colorado, hence the interest of a case of the former in a 45-year-old man, who developed a large, suppurative, inflammatory lesion over the dorsal part of the hand, presumably from the skinning and handling of large numbers of rabbits. The *Epidermophyton* concerned was characterized by round or oval, intercalary and terminal chlamydospores, 5 to 6 $\mu$ in diameter, occurring singly or in chains, in contrast to the isolated arthrospores of *Trichophyton*, and by round spores, 3 to 4 $\mu$ in diameter, deposited in groups. The mycelia, which were observed in the stratum lucidum and stratum granulosum, were of two types, (1) interlacing, wavy, 2 to 3 $\mu$ in diameter, branching, sometimes furnished with terminal clubs; and (2) straight or curved, septate, with elements of variable length and shape, with or without processes. The fungus is considered to fall into McCarthy's multiform group, represented by *E.* [*T.*] *gypseum*.

CAMPI (MARIA D.). **'Botrytis tulipae', parásito del Tulipán en la República Argentina.** [*Botrytis tulipae*, a parasite of the Tulip in the Argentine Republic.]—*Rev. argent. Agron.*, viii, 1, pp. 16–18, 2 pl., 1941.

*Botrytis tulipae* (identified by H. H. Whetzel) was isolated from straw-yellow, oval, sunken lesions, with water-soaked edges, on tulip flowers

from a Buenos Aires florist's in November, 1939, and again in June, 1941, from garden plants at San Miguel showing on the foliage elongated, depressed, pale olive-buff spots, with translucent margins; on the shoots similar, but somewhat darker spots becoming striate as growth advanced; and on the bulbs extensive, cinnamon-brown areas bearing the black, globose sclerotia of the fungus. The macroconidia, measuring 12 to 18 by 8 to 13 (mean 15·6 by 9·8) $\mu$, were found exclusively on the host, in contrast to the hyaline, globose microconidia, 3 $\mu$ in diameter, developing in culture on hyaline, penicillate conidiophores. All the 20 tulip plants inoculated with the pathogen under humid conditions contracted infection of the leaves, shoots, and bulbs, from which re-isolation was effected.

METCALFE (C. R.). **Damage to greenhouse plants caused by town fogs with special reference to sulphur dioxide and light.**—*Ann. appl. Biol.*, xxviii, 4, pp. 301–315, 1 pl., 2 figs., 2 diags., 1941.

In experiments started in 1935 in Kew Gardens, but brought to a standstill by the war, disease symptoms, which were observed to occur in greenhouse plants during or after fog (namely, shedding of flowers, buds, and leaves of begonias and other plants and the premature death of buds and flowers of orchids), were induced artificially by treating the plants with low concentrations of sulphur dioxide [*R.A.M.*, xix, p. 34]. These concentrations were found to be more toxic when the temperature and humidity were relatively high. By comparing the concentration of sulphur dioxide in the atmosphere on different days or at different times during a single day it was found that damage caused to plants was roughly proportional to the concentration of atmospheric sulphur dioxide. It was experimentally shown that disease symptoms were caused by toxic substances in the atmosphere rather than by poor illumination in foggy weather. Exposure of Gloire de Lorraine begonias for 12 hours per day to artificial light of moderate intensity from neon tubes alone or from neon tubes plus mercury vapour lamps resulted in earlier and more prolonged flowering and an increase in vigour as well as in the size of the flowers. Earlier flowering was also induced in *Euphorbia fulgens*, cineraria, and hyacinth by the same treatment and increased vigour in the first-named. By filtering the atmosphere through sphagnum soaked in 20 per cent. sodium carbonate solution sulphur dioxide was effectively removed from the atmosphere in laboratory experiments, but further trials are required before it can be generally recommended.

For the prevention of the damage the author suggests (1) making the greenhouses as air-tight as possible; (2) placing boiler-house chimneys so that the prevailing wind blows the flue gases away from the houses; (3) making the chimneys as high as possible; (4) using a fuel that emits little sulphur dioxide (e.g., oil fuel); (5) protecting valuable plants with paper coverings; (6) maintaining the plants at a temperature and humidity as low as possible; and (7) using fans to introduce filtered air from outside.

MOORE (W. C.). **New and interesting plant diseases.**—*Trans. Brit. mycol. Soc.*, xxv, 2, pp. 206–210, 1 pl., 1941.

Continuing his observations on uncommon plant diseases in England

[*R.A.M.*, xx, p. 193], the author states that in May, 1941, *Cypripedium callosum* plants in a nursery in Hertfordshire showed rounded or elongated, watery, uniformly deep brown blotches on the leaves, up to 1½ in. across, and often with a pale brown margin ⅛ in. wide, surrounded by a water-soaked halo also about ⅛ in. broad. Smaller, irregular, brown spots without the halo were also present. From infected tissues a species of *Penicillium* was isolated which was proved by inoculation experiments to cause the disease, the fungus being re-isolated. It was identified as a strain of *P. thomii* [ibid., xviii, p. 457]. Infection occurs only through wounds, and young leaves are less susceptible than older ones.

In May, 1936, the author observed *Cercosporella primulae* on leaves of a *Primula juliae* hybrid near Southampton showing the yellow-brown or brown spots generally attributed to *Ramularia primulae* [ibid., xvii, p. 113]. Some of the seedlings of this hybrid were also attacked by *Peronospora oerteliana*; the grower discarded the plants with pale or spotted foliage, and divided and replanted the remainder. Late in July, the leaves showed spots indistinguishable macroscopically from those observed earlier, but *R. primulae* alone was found on them. The two fungi are probably related genetically [cf. ibid., xviii, p. 598].

In July, 1941, two clumps of *Helenium* 'Moerheim Beauty' in the author's garden just coming into flower bud developed leaf spot. The spots measured ½ to 2 cm. in diameter, and were scattered or spread away from the leaf edges; sometimes they coalesced. They were greenish-brown, tan, or chocolate-brown, paler later, rounded, sharply defined, often with a more deeply coloured margin about ½ mm. broad, and developed chiefly on the lower leaves, occasional spots occurring on the stem leaves a foot or more above soil-level. The spots bore the pycnidia of *Septoria helenii*; they were individually pale brown with a thin parenchymatous wall, somewhat thickened and darker round an ill-defined ostiole and 66 to 112 $\mu$ in diameter. The straight or curved, hyaline, 0- to 4-septate spores were slightly pointed at the ends and measured 22 to 39 by 2 to 3 $\mu$.

Singh (B.). **Bulb rot of Scilla nutans caused by Penicillium cyclopium Westling.**—*Trans. Brit. mycol. Soc.*, xxv, 2, pp. 194–199, 1941.

During the summer of 1938, a consignment of Dutch-grown bluebells (*Scilla nutans*) was found to show rotting of the bulb scales due to *Penicillium cyclopium* [*R.A.M.*, xix, p. 221]. Bulbs obtained from English woods were similarly infected, as were imported bulbs of *S. campanulata*. Inoculation tests demonstrated that the fungus was able to penetrate wounded bulbs of *S. nutans*, *S. campanulata*, *Iris*, and *Lilium regale*, but was unable to infect unwounded *S. nutans* bulbs. Strains from *L. regale* and *Iris* were able to infect wounded *S. nutans* bulbs.

In field and greenhouse tests more disease developed in wet than in well-drained soil. Small-scale experiments indicate that infection was greatly increased when bulbs were stored under conditions of high temperature and humidity.

Snyder (W. C.). **A Fusarium wilt of Sweet William (Dianthus barbatus).**—*Phytopathology*, xxxi, 11, pp. 1054–1056, 1 fig., 1941.

The pathogen responsible for a typical wilt disease of sweet william

(*Dianthus barbatus*), first observed by C. M. Tompkins in two localities of California in 1939, presented in pure culture on potato dextrose agar the characteristic features of *Fusarium oxysporum* and gave positive results in an extensive series of soil inoculation experiments on a white-flowered variety of its own host, but not on carnations. This being the case, and in view of the fact that sweet william has not hitherto been recorded as a host of *F. oxysporum*, the fungus under observation is designated, in comformity with Snyder and Hansen's species concept in the genus [*R.A.M.*, xix, p. 495], as *F. oxysporum* f. *barbati* n.f.

VAN DER MERWE (C. P.). **Plant protection.**—*Fmg S. Afr.*, xvi, 188, pp. 371–372, 1941.

In discussing protection against the introduction of plant pests and diseases from one country into another the author states that a few years ago *Antirrhinum* [*majus*] plants imported from England were observed by a gardener to be affected by a rust [*Puccinia antirrhini*: *R.A.M.*, xx, pp. 150, 448] not previously known in South Africa. The occurrence was not reported. Eventually, the plants were destroyed, but by that time infection had become established, and since then the disease has spread all over the Union and into Rhodesia.

RUEHLE (G. D.). **Poinsettia scab caused by Sphaceloma.**—*Phytopathology*, xxxi, 10, pp. 947–948, 1 fig., 1941.

Poinsettia (*Euphorbia pulcherrima*) near Goulds, Florida, was observed in July, 1940, to be suffering from an unusual disease characterized by the development on the canes of raised, circular to elongated, often confluent cankers, 1 mm. to 1 cm. or more in length, the centres of which gradually sink and become covered with a greyish to greyish-brown, velvety layer of conidiophores and conidia of the *Sphaceloma* type. The foliar lesions are smaller than those on the canes and are mostly restricted to the petioles, midrib, and veins: except for their usually paler colour, they closely resemble the scab spots on citrus leaves due to *S.* [*Elsinoe*] *fawcetti*, and pure cultures of the fungus on potato dextrose agar also gave rise to colonies of the same type as those of the citrus pathogen. Positive results were obtained in inoculation experiments with the poinsettia organism on its own host, but not on rough lemon seedlings. Anna E. Jenkins states *in litt.* that no *Sphaceloma* disease of poinsettia is known, and further researches on the infected material are in progress.

WERNHAM (C. C.). **New facts about eastern snowmold.**—*Phytopathology*, xxxi, 10, pp. 940–943, 1 fig., 1941.

In 1939, isolations from specimens of snow mould on Colonial bent (*Agrostis tenuis*) [*A. vulgaris*] at the State College and elsewhere in Pennsylvania, yielded only a fungus identified by Ruth Remsberg as *Typhula itoana* [*R.A.M.*, xix, pp. 200, 434], while parallel isolations from similarly affected turf from Minnesota yielded a *Fusarium* and a sclerotial Basidiomycete believed to be an undescribed species of *Typhula*. In inoculation experiments with *T. itoana* the variety Astoria, a Colonial type of *A. vulgaris*, listed by Dahl and others as resistant to *F. nivale* [*Calonectria graminicola*: ibid., xiii, p. 521], proved

susceptible, the same being true in an even higher degree of the likewise reputedly resistant Metropolitan strain of *A. palustris*. Among other strains of *A. palustris* tested for their reaction to *T. itoana*, one from 'South' was resistant, one from a mixed strain susceptible, one from 'bent' very susceptible, two out of five Washingtons resistant, two moderately susceptible, and one susceptible, and Monteith's strain $C^1$, reported to be resistant to large brown patch [*Rhizoctonia* sp.: ibid., v, p. 742], very susceptible. In view of these conflicting observations, a re-classification of turf grasses in relation to their reactions to *T. itoana* would seem to be imperative.

Broadfoot (W. C.) & Cormack (M. W.). **A low-temperature Basidiomycete causing early spring killing of grasses and legumes in Alberta.**—*Phytopathology*, xxxi, 11, pp. 1058–1059, 1 fig., 1941.

Lucerne and various grasses are extensively killed off in the early spring in Alberta by an unidentified Basidiomycete, possibly allied to *Typhula* but excluded from the species studied by Ruth Remsberg [see preceding abstract] by the complete absence of sclerotia either in nature or in culture. The fungus, which was first isolated in 1931 from grasses severely damaged by snow mould [*R.A.M.*, xv, p. 811] and later from a destructive crown rot of lucerne, was pathogenic to Kharkov wheat seedlings and 22 species of grasses in inoculation experiments in 1940–1, *Bromus inermis* being the only one to give any indication of resistance. In the central and northern parts of the State the dark brown crown rot of lucerne may be responsible for the loss of up to 50 per cent. of the crop, and similar heavy damage is likewise sustained by all the clover [*Trifolium* spp.] and sweet clover [*Melilotus*] varieties so far tested. In fact, the pathogen, which develops most profusely at temperatures round about 15° C., with a minimum and maximum at −4° and 26°, respectively, is the most virulent of all those hitherto isolated from lucerne crowns and roots in Alberta.

Baur (K.), Huber (G. A.), & Wheeting (L. C.). **Boron deficiency of Alfalfa in Western Washington.**—*Bull. Wash. St. agric. Exp. Sta.* 396, 16 pp., 5 figs. (2 col.), 1941.

Surveys from 1937 to 1940 showed that boron deficiency in lucerne, commonly referred to as 'yellows' [*R.A.M.*, xxi, p. 22], is widespread in Western Washington, particularly in plantings on upland soils. The affected plants are characterized by a yellowing and reddening of the leaves, are severely dwarfed, and rarely form flowers. In pot culture studies and field trials the deficiency was satisfactorily controlled by applications of 50 to 60 lb. borax (sodium borate) per acre to silt and clay loam soils, and by 30 to 40 lb. on the lighter soils such as loams, sandy loams, and sands. Both spring and autumn applications proved to be efficient, provided the material becomes dissolved and well incorporated into the soil. Applications of farmyard manure increased the lucerne yields in all cases, but failed to eliminate the deficiency symptoms completely, while poultry manure even tended to accentuate them. The borax may be applied after mixing with commercial fertilizer or inert materials, such as sand or soil, to increase the volume before application, or directly without mixing by using equipment such as the cyclone or the wheelbarrow grass-seeder.

Darley (E. F.). **Spore germination of Selenophoma bromigena.**—*Phytopathology*, xxxi, 10, pp. 953–954, 1 fig., 1941.

In the course of a study at University Farm, St. Paul, Minnesota, on collections from Canada, North and South Dakota, and Minnesota of *Selenophoma bromigena* Sprague & Johnson, the agent of a leaf spot of *Bromus inermis* [in Oregon] (*Mycologia*, xxxii, p. 415, 1940), the type of spore germination in distilled water was observed to differ from that on nutrient media. In sterile distilled water the spore develops a germ-tube from one end, occasionally from both ends, and is recognizable for some time, whilst on potato-dextrose agar the spore swells, becomes septate, and gives off germ-tubes from both ends and from newly formed cells, as many as three hyphae arising from one cell.

Taylor (G. G.) & Atkinson (J. D.). **Experimental orchard at Huapai, Auckland.**—*N.Z. J. Sci. Tech.*, A, xxii, 6, pp. 338–347, 2 figs., 1941.

A neglected four-acre apple orchard on gum-land clay soil at Huapai, North Auckland, leased in 1937 for a three-year period by the Plant Diseases Division for experimental purposes, harboured the following fungi: powdery mildew (*Podosphaera leucotricha*), affecting particularly the Jonathan, Willie Sharp, and Gravenstein varieties; black spot [scab] (*Venturia inaequalis*) on some 50 per cent. of Willie Sharp fruit and 5 to 30 per cent. on other varieties; silver leaf (*Stereum purpureum*); and *Schizophyllum commune*, invariably associated with an unthrifty condition of the trees, and more especially with a tendency to sour sap. Following the institution of a general spray programme, full details of which are given, scab was rapidly controlled, the incidence of infection falling from 60 per cent. in 1935 to 0 to 5 per cent. after one season of spraying, and to an average of 0·1 per cent. after three years. The comparative ease with which *V. inaequalis* may be eliminated is attributed to the fact that the chief source of spring infection is the inoculum (mycelium or spores) overwintering on the tree itself.

Atkinson (J. D.) & Taylor (G. G.). **Renovation of a neglected orchard.**—*N.Z. J. Sci. Tech.*, A, xxii, 6, pp. 347–358, 6 figs., 1941.

The rehabilitation of a neglected four-acre apple and pear orchard on alluvial silt loam soil at Havelock North, which was leased by the Hawke's Bay Fruitgrowers' Association in 1935, necessitated, in addition to thorough pruning and cultivation, a full programme of disease control [see preceding abstract], chiefly directed against black spot [scab (*Venturia inaequalis* and *V. pirina*)], details of which are given. Two spray schedules are specified for the guidance of Auckland growers, the first, agreeing with the present recommendations of the Department of Agriculture, being generally applicable, and the second adapted for use in orchards where efficient disease control has already been practised, and where the methods of disinfection are of a high standard.

Britton (J. E.), Fisher (D. V.), & Palmer (R. C.). **Apple harvesting and storage in British Columbia.**—*Fmrs' Bull. Canad. Dep. Agric.* 105, 39 pp., 18 figs., 1941.

Included in this bulletin, in which 'an attempt has been made to present the problem of apple storage, not as a procedure set apart from

the rest of fruit growing practice, but as an integral part of it', are notes on some well-known storage disorders and their control.

SINGH (U. B.). **Sooty-blotch and fly-speck of Apple fruit in Kumaun.**—*Indian J. agric. Sci.*, xi, 4, pp. 597–602, 1941.

Following a brief description of the superficial blemishes of apple fruits known as sooty blotch and fly speck, the former consisting of the dark brown, interwoven hyphae and the latter of the sclerotia of *Leptothyrium pomi*, the writer gives directions for the control of the disease in the United Provinces, India [*R.A.M.*, xx, p. 477]. Spraying with lime-sulphur or Avon's colloidal sulphur is effective, but tedious and unduly expensive. Thinning the fruits so as to leave 1½ per cu. ft. of the volume of the tree appreciably decreases the incidence of infection, besides increasing the size and improving the colour of the apples. Infection during a storage period of over six months was satisfactorily held in check by washing the fruits either in 5 per cent. bleaching powder or 3 per cent. sodium chlorate.

ANDES (J. O.). **Experiments on the inheritance of the 'plus' and 'minus' characters in Glomerella cingulata.**—*Bull. Torrey bot. Cl.*, lxviii, 9, pp. 609–614, 1 diag., 1941.

A study of the inheritance of light and dark strain characters (Edgerton's 'plus' and 'minus', respectively: *Amer. J. Bot.*, i, pp. 244–254, 1914) in a race of *Glomerella cingulata* from a rotted apple from Tennessee showed that monoascosporic colonies were always light or dark. The light type is characterized by abundant light-coloured aerial mycelium, with sparse conidial development, and normal perithecia in groups, while the dark type produces very little aerial mycelium and becomes carbonaceous in a few days, forms abundant conidia and perithecia, but asci only rarely and then they are usually abnormal. When the two types are grown together a distinct line of perithecia with normal asci develops at the junction of the colonies. Asci from monoascosporic light clones yielded eight dark clones, or four dark and four light, except one perithecium which yielded five all dark and three all light clones. Monoascosporic dark clones gave asci that yielded only dark clones. Asci from perithecia that formed where the light and dark types met generally yielded eight dark clones or four dark clones and four light, though several such asci gave six dark and two light clones or two dark and six light clones. The explanation of the remarkable production of all dark clones or half dark and half light clones from asci originating from monoascosporic light lines awaits the results of further work.

Limited experiments with a northern race of the same fungus gave somewhat different results.

BAUR (K.) & HUBER (G. A.). **Effect of fertilizer materials and soil amendments on development of apothecia of Sclerotinia fructicola.**—*Phytopathology*, xxxi, 11, pp. 1023–1030, 2 figs., 1 graph, 1941.

This is an expanded account of the writers' tests at the Western Washington Experiment Station on the utility of various fertilizers and soil amendments in the suppression of the apothecia of *Sclerotinia*

*fructicola*, the agent of prune brown rot [*R.A.M.*, xxi, p. 27], a note on which has already appeared [ibid., xx, p. 24]. Calcium cyanamide, pulverized and oiled (5 per cent.), was the only one of the materials to give satisfactory results. Its toxicity is apt to be impaired by prolonged contact with wet soil, but under relatively dry conditions its fungicidal action persists over the period of two to three weeks required for the emergence of all the apothecia under local conditions. Hence it is advisable to delay the application of the compound until just before the discharge of the fruit bodies is expected. After testing several commercial machines, a home-made duster, with a capacity of 3 acres per hour, was eventually adopted, consisting of a narrowed-down motor, the hopper holding 300 lb. calcium cyanamide, which dropped directly into a 16 in. fan with 4 in. blades revolving horizontally and was blown into a 12 ft. tapered boom with $\frac{3}{8}$ in. holes at 1·5 in. intervals along its lower side, the outer 18 in. section being elevated at an angle of 45° to permit of dusting the entire soil surface without cross treatment. The boom was fitted with a burlap hood, 3 ft. wide, over a framework of iron pipe and bamboo rods to prevent the dust from blowing into the trees [cf. ibid., xx, p. 336].

Cation (D.). **The line pattern virosis of the genus Prunus.**—*Phytopathology*, xxxi, 11, pp. 1004–1010, 4 figs., 1941.

Abundance and Red June plum trees with apparently normal foliage may transmit to Elberta, Hale, and Carmen peaches, Mahaleb cherries, and almonds by grafting a disease manifested by a faint mottling of either a line-pattern or diffused type; *Prunus salicina* is also susceptible, but frequently shows no external symptoms of infection. The virus responsible for the trouble, which is apparently similar to, or identical with, that described by Valleau [*R.A.M.*, xii, p. 454] and Thomas and Rawlins (as 'Vacaville plum mosaic') [ibid., xix, p. 417], is herein designated peach line-pattern virosis (*Marmor lineopictum*). It is probably general throughout the United States, and is actually known to occur in Kentucky, Michigan, California, and Ohio. Another disorder of Abundance plums resembling in some respects that caused by Valleau's unnamed virus and perhaps related to Thomas and Hildebrand's prune virus [ibid., xvi, p. 330], designated Prunus virus 6 by K. M. Smith [ibid., xvii, p. 52], failed to transmit perceptible symptoms to peach in three inoculations.

Berkeley (G. H.). **Prune dwarf and Shiro line-pattern mosaic.**—*Publ. Div. Bot. Pl. Path., Ottawa*, 679, 2 pp., 2 figs., [1941].

Two Shiro plum and three prune orchards in Ontario have been found to be affected with virus diseases new to the Province, the former with 'line-pattern mosaic' [see preceding abstract], the latter with 'dwarf' [*R.A.M.*, xvi, p. 330]. In prune dwarf the leaves on infected branches become reduced in size, narrow, rugose, distorted, and somewhat glazed, so that they rather resemble willow leaves; the disease is, in consequence, sometimes referred to as prune 'willow leaf'. Affected shoots often occur on an otherwise apparently healthy branch, diseased shoots being interspersed with apparently healthy ones. Fruit from affected branches appears normal, but yield is greatly reduced. The disease has

also been reported from New York State and British Columbia. In two of three orchards affected in Ontario the condition appeared after damsons had been top-worked with Italian prune.

In the two Shiro plum orchards the affected trees in early summer showed yellowing of the veins of the leaves, with pronounced yellowish patterns. Subsequently, the yellow areas turned almost white. Foliage emerging in hot weather did not always show any symptoms, which were, however, conspicuous on leaves unfolding earlier and on those formed in cooler weather. In one of the orchards some plums of the 'First' variety were slightly affected. Twenty-five Shiro trees were top-worked with First, and next season became affected. In two years, the condition was present on a further 34 trees. Examination of the First trees from which the scions were taken showed the presence of the disease, and the available evidence indicated that these First trees were responsible for the initial infection in both Shiro orchards.

As both diseases have been discovered in top-worked orchards, growers are advised to take special care to see that trees to be top-worked are healthy. No bud sticks or scions should be taken from any but healthy trees. Prune trees affected with dwarf should be destroyed.

BERKELEY (G. H.). **The 'X' disease on Peach and Chokecherry.**—*Publ. Div. Bot. Pl. Path., Ottawa*, 678, 2 pp., [1941].

The first records of 'X' disease of peaches [*R.A.M.*, xx, p. 540] in the Niagara Peninsula, Ontario, were made on 25th July, 1941, but much of the evidence indicates that the disease has been present in some orchards for four years. A limited survey showed that though the western section of the peninsula (Bartonville district) is chiefly affected, some 70 diseased trees were found in the vicinity of Niagara town, and one near Beamsville. Spread takes place only from chokecherry (*Prunus virginiana*) to peach and not from peach to peach. In Connecticut and New York States, the disease has spread so rapidly in some localities that some orchards have become useless from a productive standpoint in only two years. In Ontario, spread has been less rapid, e.g., in two orchards where it is considered that the condition has been present for four years only 7 and 15 per cent., respectively, of the trees are affected. Every step must, however, be taken to check spread. Control consists in destroying all chokecherries within 500 ft. of any peach orchard by spraying them while in full leaf with a proprietary weed killer which has a sodium chlorate base, or with sodium chlorate alone used at the rate of 1 lb. per gal. water. It may be necessary to repeat the application a year later. The spray should be used at the rate of 1 or 2 gals. per 100 sq. ft. of area.

NATTRASS (R. M.). **Notes on plant diseases.**—*E. Afr. agric. J.*, vii, 2, p. 68, 1 fig., 1941.

Peaches, almonds, and nectarines are attacked by *Taphrina deformans* [*R.A.M.*, xx, p. 558] in Kenya, particularly at the higher altitudes, where the low temperatures and high humidity prevailing during part of the year favour infection. Brief directions for control are given.

THURSTON (H. W.), TAYLOR (C. F.), GROVES (A. B.), & MILLER (H. J.). **Interstate cooperative experiments on field spraying of sour Cherries.** —*Phytopathology*, xxxi, 11, pp. 1047–1050, 1941.

A fully tabulated account is given of co-operative experiments conducted in 1940 in Virginia, West Virginia, and Pennsylvania to determine the most effective preparations for the control of cherry leaf spot (*Coccomyces hiemalis*) [*R.A.M.*, xx, p. 481], on the Montmorency variety in 13 single-tree plots and a check, randomized and replicated sixfold within each State, four applications being made at (1) petal-fall, (2) shuck-fall, (3) three-week cover, and (4) post-harvest. After eliminating Bordeaux mixture and tank-mix copper phosphate because of their detrimental effect on the size of the fruit, and lime-sulphur and phenothiazine on account of their consistent failure to combat the pathogen, there remained for further consideration nine materials, of which basicop and ZO were rejected for the inconsistency of their performance, their efficacy in the late outbreak of the disease in West Virginia not being maintained under the more exacting conditions prevailing in the other two States. Compound A ensured the best average leaf retention for the three States, with 76·18 per cent. still on the trees in the first week of October, followed by Tennessee '26' and Nu-film, Tennessee '26' alone, copper hydro '40', and cupro K, with 74·73, 72·47, 72·00, and 71·77 per cent., respectively, the control figure being 4·67 per cent. The numbers of cherries per pound sample treated by these five preparations were 119·4, 113·3, 117·8, 112·2, and 113, respectively, compared with 107·6 for the control.

DODGE (B. O.) & WILCOX (R. B.). **Diseases of Raspberries and Blackberries.**—*Fmrs' Bull. U.S. Dep. Agric.* 1488, 33 pp., 20 figs., 1941.

In this revised edition (by J. B. Demaree) of the earlier bulletin by Dodge and Wilcox on the same subject [*R.A.M.*, vi, p. 40], the more important fungal and virus diseases of raspberries, blackberries, and dewberries [*Rubus* spp.] found in the United States are described and illustrated, and practical recommendations are given for their control.

CROUCHER (H. H.). **Efficient spraying to control leaf spot.**—*J. Jamaica agric. Soc.*, xlv, 8, pp. 284–287, 1941.

After pointing out that there is considerable evidence of inefficient spraying by banana-growers against leaf spot due to *Cercospora* [*musae*: *R.A.M.*, xx, p. 265] in Jamaica, the author gives a scale by which the intensity of infection on sprayed and unsprayed banana plants may be estimated (ranging from stage 1, unaffected, to stage 6, very heavy infection, i.e., very severe spotting, plantations of a prevailing brown or scorched appearance, with premature ripening of the bunches on the plants). He states that it is not as yet possible to tell at what precise stage of infection a tree will just fail to produce marketable fruit, especially as this may vary with different localities and seasons. Efficient spraying should, however, reduce infection at least to stage 2 (very slight infection, only occasional, isolated leaf spots present), and this should be every grower's aim. If bananas sprayed regularly for three to four months have more spots than are present in stage 3 (slight infection, general light spotting of the leaves, or light spotting in

certain areas of the field), then the spraying is probably inefficient. If the trees are in stage 4 (moderate infection, general light spotting with localized patches in which many leaves per plant are severely affected or 'badly burned'), either the spraying methods are radically wrong, or infection was too heavy to begin with.

The main causes of inadequate control by spraying are (1) not cutting back heavily infected trees before beginning to spray, (2) irregular spraying cycles, and (3) poor coverage by the spraying mixture. The minimum cycle advised for all areas is three to four weeks. In some places, especially where an infected area is being brought under control, the applications should be made even more frequently. If the number of new leaves showing no sign of spray mixture is multiplied by 10, the result gives the minimum number of days elapsing since the last spraying. Poor coverage may be due to careless application, allowing the pump or jet to get out of order, using too little spray (minimum, $\frac{1}{3}$ gal. per tree with power equipment, $\frac{1}{4}$ to $\frac{1}{5}$ gal. with hand sprayer), or spraying with a mixture rendered unsatisfactory by inaccurate measurement of the materials or by a faulty method of preparation.

**Bunchy top position at Yarrahappini.**—*Banana Bull., Sydney*, i, 62, pp. 9, 16, 1941.

The position as regards bunchy top of bananas in the Yarrahappini area of New South Wales [*R.A.M.*, xix, p. 31; xx, p. 171] is not yet such as to admit of the lifting of the quarantine restrictions, but substantial progress has been made since the inception of the campaign against the disease four years ago, only four infected plants having been found during the present season as compared with 99 in the first.

WAGER (V. A.). **The dying back of Avocado trees in southern California.**—*Yearb. Calif. Avocado Ass., 1940*, pp. 40–43, 1940. [Abs. in *Biol. Abstr.*, xv, 10, p. 2273, 1941.]

Debility, sparse foliation, and crop failure are among the symptoms of a die-back affecting some 500 acres of avocado plantings in southern California. The roots of diseased trees were discoloured and necrotic, the larger ones also bearing cankers and showing signs of decay, while the lesions on those of all sizes yielded *Phytophthora cinnamomi*, which readily infected plants submerged for only one day following inoculation, though in the absence of the pathogen the roots can withstand six to nine days' submersion without injury.

PARRIS (G. K.). **Diseases of Papaya in Hawaii and their control.** *Ex* **Papaya production in the Hawaiian Islands.**—*Bull. Hawaii agric. Exp. Sta.* 87, pp. 32–44, 7 figs., 1941.

The following diseases of papaw are described as occurring in Hawaii. Anthracnose (*Colletotrichum gloeosporioides*) [*R.A.M.*, xxi, p. 88] is spread by wind, rain, insects, and probably man, while partly or completely rotted fruits on the refuse heap or over-ripe fruits on the tree constitute a serious source of infection. While the use of Bordeaux mixture is not advised owing to risk of russeting that is caused by it, it is reported that Kikuta (*Progr. Notes Hawaii agric. Exp. Sta.* 18,

5 pp., 1941) obtained 98 per cent. control of anthracnose without injury to the tree or fruit by spraying with cuprocide 54 and cuprocide 54 Y.

Fruit rot caused by *Alternaria* (? *citri*) is stated to be relatively unimportant in Hawaii and needs no special treatment, as it is controlled by the sprays applied against anthracnose.

Powdery mildew, caused by *Oidium caricae* [*R.A.M.*, xxi, p. 88], is satisfactorily controlled by spraying with copper or sulphur fungicides at monthly intervals, or more often if the disease recurs sooner.

*Phytophthora parasitica* [ibid., xx, p. 350], causing a hard rot of the stem, the fruits, and occasionally the collar and roots of the plant (leaves were seen attacked in the laboratory only), was observed at several localities on the island of Oahu and it is believed that it may become a serious menace. For the control of this disease Bordeaux mixture is not recommended on account of russeting, but spraying with a copper fungicide is stated to give satisfactory results. When the stem is decapitated below the diseased region, suckers develop and fruit formation is resumed earlier than when young trees are planted.

Root rot, due chiefly to *Pythium* spp. (one of which was identified by J. T. Middleton as *P. aphanidermatum* [ibid., xx, p. 480]) and to a lesser degree to *Fusarium* spp., causes a retardation in the growth of the plants, premature leaf fall, stunting of the apex, stem rot, and poor anchorage of the roots, which are discoloured and partly decayed. The fungi enter the roots through wounds or directly if they are unthrifty. Diseased plants should be uprooted and burnt, the holes left exposed to the sun or disinfected with a weak Bordeaux solution, and not replanted for some time. Root rot is particularly favoured by excessive moisture and flooding should, therefore, be avoided.

Species of *Pythium* and *Rhizoctonia* are held responsible for a post-emergence damping-off [cf. ibid., xx, p. 350] often causing severe losses of seedlings. The plants wilt rapidly showing a darkened, water-soaked spot on the stem near soil-level, turn brown, dry out, and die, sometimes becoming covered with a darkish or light grey mould. The disease can be controlled by soil sterilization with heat or formaldehyde at least 10 days or preferably a fortnight before planting, the best means, steam, being too expensive to administer.

It is confirmed that mosaic has been absent from the island of Oahu since 1939 [loc. cit.].

Parker Rhodes (A. F.). **Studies on the mechanism of fungicidal action I. Preliminary investigation of nickel, copper, zinc, silver and mercury.**—*Ann. appl. Biol.*, xxviii, 4, pp. 389–405, 1941.

In a study on the fungicidal action of metals, the effects of various compounds of nickel, copper, zinc, silver, and mercury were observed on *Macrosporium sarcinaeforme* [*Stemphylium sarciniforme*: *R.A.M.*, xix, p. 665] and *Botrytis allii*. The interpretation of the results obtained was based on two theorems: (1) if the tolerance (measured by the atomic concentration of metal just sufficient to prevent germination of the given spore) of spores towards a certain compound is normally distributed, the variability (defined as a statistic involving the second but no higher moment of the variate, which is the tolerance of spores to the action of metallic ions) can be measured by the relative variance, that

is, the ratio of the variance to the square of the mean; and (2) if the logarithm of the tolerance is normally distributed, the variability can be measured by the variance of the logarithm. The following conclusions, put forward only as the simplest explanation of the facts, were drawn from the results: copper is absorbed by the spores more readily in the form of the monohydrated dithioureocuprous ion, or a related compound, than as the simple cupric ion, certain cupric complex compounds apparently requiring decomposition before absorption; zinc is more readily absorbed as the dithioureozinc ion; silver in the form of the dithioureargentous ion requires decomposition (at least as was observed in one case) before absorption; mercury in the form of the tetrathioureomercuric ion requires decomposition before absorption. It appeared that the variability is less affected by temperature fluctuations than by some other statistics.

PETRI (L.). **Einige Fragen der allgemeinen Pflanzenpathologie.** [Some problems of general phytopathology.]—*Ann. Fac. agr. Pisa*, N.S., iii, pp. 229–261, 1940. [Abs. in *Chem. Zbl.*, cxii (ii), 20, p. 2452, 1941.]

The writer's studies are concerned primarily with the immunity of plants from diseases and parasites or their resistance to these agents. On the grounds of practical experience he rejects the serological and internal-therapeutic methods of control, and envisages a successful outcome of the attempts in progress at the extension of resistance by the development of new strains with the required characters or the propagation of those already in existence.

CARTER (W.). **Insects and the spread of plant diseases.**—*Rep. Smithson. Instn, 1939–40*, pp. 329–342, 6 pl., 1941.

The writer cites some important examples of the part played by insects in the transmission of plant diseases, and discusses the implications of this mode of dissemination in connexion with control problems and future developments in phytopathological knowledge.

ROMELL (L.-G.). **Localized injury to plant organs from hydrogen-fluoride and other acid gases.**—*Svensk bot. Tidskr.*, xxxv, 3, pp. 271–286, 1 fig., 1 graph, 1941.

Norway maples (*Acer platanoides*) and oaks in a park in Sweden some 400 m. distant from a factory emitting fluoric gases developed marginal leaf curl, accompanied in the case of the purple-leaved form of *A. platanoides* by a dulling of the normal colour of the edges only, the remainder of the leaf surface being unaffected. Ordinary Norway maples and oaks showed foliar blotches of a slightly paler than normal green, while the margins of apple leaves turned brown, and in some cases patches of discoloured tissue were also present on the surface. An analysis of the fluorine contents of (a) visibly damaged parts, (b) remaining portions of the same leaves, and (c) leaves with no apparent injury yielded the following data: ordinary Norway maple, 42, 0, and 0 parts per million dry weight, respectively, purple-leaved, 22, 16, and 6, respectively, and apple, 17, 0, and 0, respectively.

Discussing the etiology of localized lesions from acid gases in smoke

[*R.A.M.*, xvi, p. 701, and cf. above, p. 140] the writer refutes the idea that they are due to 'corrosion', i.e., the direct absorption of acid from a liquid through the cuticle independently of the stomata, and attributes the so-called 'border effect', typified by the injuries described above, to an uneven uptake of acid gas in a distorted diffusion field, along the protruding edges of which the critical threshold is first reached.

The use of indicator papers for the estimation of the atmospheric content of certain acid gases is suggested: an easily prepared aluminium-haematein lake paper (prepared by staining hardened filter paper overnight in Delafield's haematoxylin diluted 1 in 100 distilled water, washing in tap water, then in distilled water, and drying), for instance, was found to give a sensitive and specific border reaction to hydrogen fluoride. Tests with such papers showed that hydrogen chloride, hydrogen fluoride, and nitric acid are much more liable to induce the border effect than the considerably less soluble, and hence less readily absorbed sulphuric acid.

FURRY (MARGARET S.) & ROBINSON (HELEN M.). **Effective mildew-resistant treatments for Cotton fabrics.**—*Amer. Dyest. Rep.*, xxx, 20, pp. 504, 520–523, 1941.

In continuation of previous studies initiated by the United States Bureau of Home Economics (*Industr. Engng. Chem.*, xxxiii, 4, pp. 538–545, 1941), the writers tested finishing treatments for the control of mildew (*Chaetomium globosum*) on an 8-oz., de-greased and de-sized, unbleached cotton duck fabric [*R.A.M.*, xxi, p. 89], strips of which were inoculated with the fungus and incubated for a fortnight.

Very satisfactory protection was afforded by the acetylation process, involving 20 hours' exposure to acetic anhydride, glacial acetic acid, and zinc chloride at 20° to 25° C.; 30 minutes in a 15 per cent. solution of chlorothymol (25° to 30°), refluxed for four hours with morpholine and sodium carbonate to form an oil yielding crystals which melt at 54°; cutch (100°, overnight), followed by 10 to 15 minutes in copper sulphate and ammonium hydroxide at 25° to 30°; 2-chloro-orthophenylphenol and pentachlorophenol (30 minutes), which may also be condensed with morpholine to eliminate the sharp, irritating odour of these products, while a two-bath treatment with (a) cadmium chloride and (b) sodium pentachlorophenolate (15 minutes each) also proved eminently satisfactory for the inhibition of the mould; salicylanilide (30 minutes at 25° to 30°) for non-steam-sterilized material, or in the form of an emulsion mixed with wax and aluminium acetate (3 minutes at 80° to 85°) for steamed fabrics; 30 minutes at 25° to 30° in alkyl dimethyl benzyl quaternary ammonium phosphate or chloride; copper propionylacetate, paratolyl mercury salicylate, and phenyl mercury oleate, all for 30 minutes at 20° to 25°, the first-named imparting a grey-green tint to the material; copper and zinc naphthenates, applied either in water or Stoddard solvent for 30 minutes at 25° to 30°, the former green, the latter colourless, both having a pungent, disagreeable odour and tending to stiffen the fabric; two-bath processes of sodium oleate soap with cadmium chloride or copper sulphate, 10 minutes in the soap and 30 in the chemicals, both at 100°; cadmium chloride or copper sulphate (15 minutes at 100°), followed by 15 minutes in morpho-

line at 25° to 30°; 30 minutes in either aluminium acetate or magnesium chloride at 100° and 15 in 8-hydroxy quinoline at 25° to 30° (bright and dull yellow, respectively); and 30 minutes in cadmium chloride at 25° to 30° followed by 10 in borax.

None of these treatments caused any appreciable loss in the strength of the fabric, and a few even seemed to increase it. In this connexion it is pointed out that a change in breaking strength due to mildew growth is of little or no importance even under the exacting conditions provided by laboratory experiments, while for many practical purposes treatments permitting 20 or 25 per cent. deterioration would be quite reliable.

THOMPSON (J. C.) & SANFORD (W. E.). **Modern paints for mold control in the brewery.**—*Brew. Dig.*, xvi, 5, pp. 27–30, 4 figs., 1941.

The moulds most frequently encountered in American breweries [*R.A.M.*, xix, p. 718] are stated to be *Aspergillus glaucus*, *Penicillium glaucum* (in green malt), and *Botrytis cinerea* (on wort). Collectively these organisms are responsible for heavy losses every year, and many experiments have been undertaken with a view to their control. In this connexion it is necessary to run constant tests for the evaluation of the efficacy of various fungicides and paints, which may be carried out by means of a wooden box, 3 ft. in width, 8 ft. in length, and 3 ft. in depth, the bottom of which is filled to a depth of 6 or 8 in. with water heated by an electric immersion heater, while across the centre is a partition extending from the top down to just above the water-line. The panels painted with the test substances are hung on pegs round the sides, and the top is fitted with hinged covers, the temperature being maintained at 84° F., the optimum for the majority of moulds. The cabinet thus provides ideal conditions for fungal growth, viz., warmth, moisture, and darkness, the only missing element being food, which is supplied by the paints themselves. Hundreds of tests have been run in this cabinet and, in conjunction with practical experience, have contributed extensively towards the incorporation of fungicidal substances in the interior finishings of breweries and other food-manufacturing installations.

Among the requisites of a modern paint, besides resistance to moulds, are maximum resistance to discoloration in the presence of fumes, gases, heat, or protracted absence of daylight; suitability for application at low temperatures in excessively moist conditions; and freedom from toxicity to foodstuffs, beverages, and the like. Before applying new paint, the surfaces should be thoroughly cleansed with a solution of trisodium phosphate or sodium carbonate in hot water, and drying should be followed by sterilization with sodium hypochlorite in water, using either a calcimine brush or spray equipment. After further alternate drying and rinsing, the new paint is applied, the final coat, the 'fungicide clear coat', consisting of a thin, colourless, antiseptic film effectively retarding bacterial and fungal growth.

JONES (L. H.). **Coin mats for the microscopist.**—*Science*, N.S., xciv, 2445, p. 446, 1941.

The use of coin mats is recommended to facilitate the handling of cover glasses and slides.

**Proceedings.**—*Trans. Brit. mycol. Soc.*, xxv, 2, pp. 215–220, 1941.

Abstracts of the following papers read at meetings of the British Mycological Society in 1941 have not been noticed from other sources. Dillon Weston, discussing field observations on cereal diseases and their control, states that no marked difference was observed from year to year in the intensity of loose smut (*Ustilago tritici*) infection on well established English wheat varieties, but certain recently introduced varieties have been more seriously affected. In experimental work grain treated by the hot water method is dried over a wind channel, as the germinating capacity of stored moist grain is impaired. The farmer is usually advised to obtain seed from a healthy crop or to change to a resistant variety. Wheat varieties infected with *Tilletia caries* generally show increased susceptibility to *Puccinia glumarum*. Doubt is expressed whether barley leaf blotch (*Rhynchosporium secalis*) [*R.A.M.*, xix, p. 643] is as unimportant as it is sometimes considered to be. There is no experimental evidence that infection is seed-borne; the disease probably carries over from year to year on rogue barley and on grasses.

S. P. Wiltshire presented evidence of the continued spread of major crop diseases in spite of legislation, and cited instances where appropriate action might have prevented the introduction of disease had information been available. He suggested that better intelligence is required about the distribution of plant diseases, their methods of transmission, and trade channels.

F. C. Bawden reported that, many plant pathologists being dissatisfied with present methods of recording plant diseases in the field, a special meeting of the Plant Pathology Committee was held in February, 1941, and a model scheme drawn up for recording the incidence of six diseases.

Frampton (V. L.) & Longrée (Karla). **The vapor pressure gradient above a transpiring leaf.**—*Phytopathology*, xxxi, 11, pp. 1040–1042, 1 graph, 1941.

The microclimate adjacent to the leaf surface plays an important part in fungal development, and the authors have devised a method of determining the relative humidity at the surface of a leaf based on the equation: $\log(R-S)-\log M = -\frac{v}{D}x$, where R = relative humidity at a given distance from the surface, S = relative humidity at a long distance from the surface, D = diffusion constant, v is the normal component of velocity induced by an extraneous disturbance, e.g., streaming, convection currents, or gravitational force, and M assumes the dimensions of relative humidity. At the surface of the leaf $R = M+S$, and it is only necessary under suitable experimental conditions to measure S and R at two arbitrary points in order to determine the relative humidity at the leaf surface.

Lindegren (C. C.) & Lindegren (Gertrude). **X-ray and ultraviolet induced mutations in Neurospora. I. X-ray mutations.**—*J. Hered.*, xxxii, 11, pp. 404–412, 2 figs., 1941.

In the authors' experiments at the University of Southern California, Los Angeles, the exposure of uninucleate spores of *Neurospora crassa* to

X-rays (25 minutes at 13,750 or 40 at 22,000 r units) induced both gene mutations and chromosal aberration. Abortion of ascospores occurred in the progeny of about half the mutants, and one such case, which is fully analysed, was specifically identified as an inversion. Many of the cultures in which mutation was induced became heterokaryotic through reverse mutation.

ALEXOPOULOS (C. J.). **Studies in antibiosis between bacteria and fungi. II. Species of Actinomyces inhibiting the growth of Colletotrichum gloeosporioides Penz. in culture.**—*Ohio J. Sci.*, xli, 6, pp. 425–430, 1941.

Continuing his investigations on the inhibition of fungal growth in culture by bacteria grown in association with fungi [*R.A.M.*, xviii, p. 129], the author grew *Colletotrichum gloeosporioides* (from diseased orange twigs from Greece) on a synthetic medium in Petri dishes, in the presence of each of 80 different [named] species of *Actinomyces* obtained from the Centraalbureau voor Schimmelcultures, Baarn.

The results obtained indicated that the growth of *C. gloeosporioides* was inhibited over a distance of 10 mm. or more by strong inhibitors (of which 14 were found, including *A. scabies*), less than 10 mm. by weak inhibitors (31), while non-inhibitors (35) exerted no effect. Filtrates from liquid cultures of representative species of the three groups were then used in preparing nutrient agar for *C. gloeosporioides*, and after 7 days' incubation the colonies of this fungus ranged from 18 to 34 mm. on medium prepared from the filtrate of strong inhibitors, compared with 62·5 mm. for the control; filtrates from weak or non-inhibitors were without effect.

Little doubt can be entertained that inhibition of fungal growth was due to some toxin manufactured in the medium by the Actinomycetes, and the difference between inhibitors and non-inhibitors may be due to the ability of some and the inability of other Actinomycetes to produce a substance toxic to the fungus. Various hypotheses regarding the action of the inhibitors are discussed.

An autotoxic substance similar to the toxin produced by the Actinomycete inhibitors cannot be postulated for *C. gloeosporioides* because two colonies of the fungus when grown in the same Petri dish merged.

WEINDLING (R.). **Experimental consideration of the mold toxins of Gliocladium and Trichoderma.**—*Phytopathology*, xxxi, 11, pp. 991–1003, 1 graph, 1941.

In the course of studies on the factors determining the production, stability, and activity of the crystalline toxin yielded by the mould *Gliocladium fimbriatum* [*R.A.M.*, xvii, p. 337], certain fungi that had given evidence of antagonism to *Rhizoctonia* [*Corticium*] *solani* in culture media were investigated with respect to the toxicity of their filtrates after two days' growth on a liquid glucose-peptone substratum at $P_H$ 4·5. Potent filtrates were derived from *G. fimbriatum* and pigmented isolates of *Trichoderma* [? *viride*: ibid., xiv, p. 248], extraction being effected with lipoid solvents, of which chloroform (40 per cent. of volume of filtrate) was the most effective.

The gliotoxin is produced for the most part during the first $2\frac{1}{2}$ days of

growth, at which period the toxicity of *G. fimbriatum* towards its competitors also reaches a maximum. The shaking-culture method of Kluyver and Perquin (*Biochem. Z.*, cclxvi, pp. 68–81, 1933), with certain modifications, notably in an increased velocity of 90 to 100 movements per minute, was found to expedite the life-cycle of the fungus, thereby facilitating the purification of the toxin by obviating the accumulation of other chloroform-soluble substances during protracted culture.

Satisfactory yields of gliotoxin were dependent on an abundance of oxygen and high acidity ($P_H$ 5 and downwards). Ammonium salts were better sources of nitrogen than peptone or nitrates, while the best carbon supplies were obtained from glucose and sucrose, glycerine and levulose reducing output. Large-scale production of the toxin was carried out on non-sterilized media at $P_H$ 2·5 to 3 in 3- or 6-l. flasks, the influence of contaminants being minimized during the brief growth period of three days by the high acidity of the substratum.

In relation to the germinating spores of *Sclerotinia americana* [*S. fructicola*] and *C. solani*, the fungicidal action of gliotoxin exceeds that of copper sulphate and falls below that of mercuric chloride.

In neutral and acid solutions the toxin remains stable for several weeks at room temperature, whereas increasing alkalinity induces a high degree of instability, the rate of decomposition likewise being accelerated by rising temperatures; at 37° C., for instance, samples of $P_H$ 7·1 lost from $\frac{2}{3}$ to $\frac{3}{4}$ of their toxicity within 24 hours, while toxic solutions of $P_H$ 2·4 are not affected by 30 minutes' exposure to 122°. Thermostability decreases with falling acidity, especially beyond $P_H$ 5. The maximum amount of activity of gliotoxin in experiments with *C. solani*, was exerted at $P_H$ 8·2, while at $P_H$ 9·5 toxicity was lost immediately; the toxicity of the substance increased with rising temperatures in tests up to 32·5°.

TURNER (W. I.) & HENRY (V. M.). **Growing plants in nutrient solutions or scientifically controlled growth.**—xiii+154 pp., 19 figs. (3 col.), 8 diags., 2 graphs, New York, J. Wilby and Sons, Inc.; London, Chapman and Hall, Ltd., 1939. [Received December, 1941.] $3.

This well-illustrated manual, based largely on the first-named author's practical experience, supplemented by information drawn from the pioneer studies in this field of various American and Canadian experiment stations, contains full directions for the growth of plants in nutrient solutions, and includes several chapters of interest to phytopathologists, dealing, e.g., with the essential elements and their functions in plant development and the diagnosis of deficiency symptoms [*R.A.M.*, xxi, p. 42].

SOMMER (ANNA L.). **Mineral nutrition of plants.**—*Annu. Rev. Biochem.*, x, pp. 471–489, 1941.

Included in this survey of recent contributions to the study of the mineral nutrition of plants are a number of papers dealing with the pathological effects of deficiencies of various essential elements.

HUTCHINS (H. L.) & LUTMAN (B. F.). **Staining scab Actinomyces in Potato tuber tissues.**—*Stain Tech.*, xvi, 2, pp. 63–66, 1 fig., 1941.

Scab (*Actinomyces*) [*scabies*] hyphae embedded in the middle lamellae

of potato tuber cells were located in sections at the Vermont Agricultural Experiment Station by the use of a modified Gram staining technique [*R.A.M.*, xxi, p. 38] involving the following steps: (1) treatment with xylol, absolute alcohol, 95 per cent. alcohol, and then washing in water; (2) staining for 24 hours in a solution of 10 c.c. 95 per cent. alcohol, 2. c.c. aniline oil, 88 c.c. distilled water, and 5 gm. crystal violet; (3) washing in water to remove excess stain; (4) immersion in Gram's iodine solution for 24 hours; (5) washing in absolute alcohol until no more colour flows out of the sections; and (6) clearing in xylol, followed by mounting in Canada balsam dissolved in xylol.

LUTMAN (B. F.). **The reappearance of Potato scab in infested and its appearance in almost uninfested land.**—*Amer. Potato J.*, xviii, 3, pp. 65–80, 3 diags., 1941.

In 1935 a plot at the Vermont Agricultural Experiment Station utilized from 1914 to 1916 as a testing ground for potato varieties and known at that time to be infested by scab [*Actinomyces scabies*: *R.A.M.*, iii, p. 61] was replanted with disinfected Green Mountain seed and enriched with commercial fertilizer. During the intervening period the pathogen was presumed to have lost its virulence or died off, the percentage of badly scabbed tubers in susceptible varieties having declined from nearly 100 to 3·3 per cent. Of the apparently clean 70 per cent., however, many when freshly dug showed the typical pock marks of deep scab, which on drying merely presented the russet aspect typical of certain varieties. For the next five years the plot was again planted with Green Mountains for further investigations, and in 1938 the original site was extended threefold by the addition of wings of the same size to the north and south, on which no potatoes had been grown for 30 years. In that year's harvest, taken as a whole, the old plot produced only 13·2 per cent. clean tubers and the new wings 91·1 per cent., the percentages of badly scabbed tubers on the old and new land being 35·3 and 0·3, respectively. In 1939 the old plot yielded 59·7 per cent. badly and 35 per cent. slightly scabbed tubers, and the new ones 3·6 and 41·8 per cent., respectively, the corresponding figures for 1940 being 85 and 15 and 15 and 45, respectively.

No entirely convincing explanation of the recrudescence of scab on the old plot can be presented, but the spread of the pathogen to the virgin soil was presumably initiated by cultural practices and perpetuated by the gradual acclimatization of the organisms to their new habitat. Other conditions being equal, a high soil moisture content and capacity for moisture retention are the predominant factors in the promotion of scab activity in light sandy loam soils.

HOLMBERG (C.). **Potatiskräftans bekämpande och Potatissortfrågan. 2. Potatissortfrågan.** [Potato wart control and the question of Potato varieties. 2. The Potato variety question.]—*Landtmannen, Uppsala*, xxv, 10, pp. 195–198, 3 figs., 1941.

About 20 potato varieties immune from wart disease [*Synchytrium endobioticum*] are stated to be now in cultivation in the 54 'protected

areas' of Sweden [*R.A.M.*, xx, p. 378], the chief varieties being Dukker and Irish Cobbler in the early group, King George V, Majestic, Alpha, Arran Consul, and Ackersegen in the medium to late, and Parnassia and Voran in the fodder and industrial. The distinguishing characters of these and other less widely grown varieties are described, with notes on their adaptation to local conditions.

McLean (J. G.) & Walker (J. C.). **A comparison of Fusarium avenaceum, F. oxysporum, and F. solani var. eumartii in relation to Potato wilt in Wisconsin.**—*J. agric. Res.*, lxiii, 9, pp. 495–525, 5 figs., 3 graphs, 1941.

In a comparative study of the three wilt diseases of potato in Wisconsin, *F. oxysporum* [*R.A.M.*, xxi, p. 39], *F. solani* var. *eumartii* [loc. cit.], and *F. avenaceum* [ibid., xvii, p. 409], a strain of the last-named fungus isolated from diseased potato plants proved capable of producing infection and discoloration of the stems, stolons, roots, and tubers from which the fungus could be reisolated. The 12 single-spore isolates of this fungus tested produced three more or less distinct classes of infection. In both greenhouse and field inoculation experiments, *F. solani* var. *eumartii* produced the most severe type of wilt (particularly in Rural New Yorker variety, which together with Irish Cobbler was generally more susceptible to the wilt fungi than either Bliss Triumph or Katahdin), while the other two species, though differing in symptoms and temperature requirements for growth, were similar in the severity of disease, the percentages of infection, the time of appearance of foliage symptoms and the temperature most favourable for infection. In Wisconsin *F. solani* var. *eumartii* is confined largely to the north-eastern part of the State where it may infect 8 per cent. of the plants in the field, but it is not the serious problem that it is in some other parts. *F. oxysporum* and *F. avenaceum*, in equal proportions, are largely responsible for potato wilt in Wisconsin.

In field experiments, inoculation of seed pieces at planting time was used successfully with all three species, early planting of inoculated seed pieces resulting in a greater percentage of infection and more severely diseased tubers than did late planting. In the host tissue, the mycelia of *F. oxysporum* were closely confined to the xylem vessels of the stem; those of *F. avenaceum* occurred abundantly in both vascular and cortical tissues of the lower stem; and those of *F. solani* var. *eumartii* were most abundant in the stem cortex. All three pathogens showed rapid penetration of the roots. Heavy-walled xylem cells filled with a dense granular deposit and disintegration of certain cells of the phloem and xylem of the stem were associated with infection by all three species; abnormal effects in the host tissue in advance of fungal invasion was greatest in plants inoculated with *F. solani* var. *eumartii*.

Optimum growth of potato and of the strain of *F. avenaceum* used occurred at air temperatures between 20° and 24° C. A soil temperature of 28° was most favourable for infection of the potato plant. A moist soil with the water-holding capacity maintained at 50 per cent., was more conducive to infection than were either dry or wet soils with the moisture capacity at 30 or 70 per cent., respectively.

Infected plants at Starks, in the northern part of the State, displayed

symptoms not pronounced at Madison in southern Wisconsin, such as leaf-rolling, -reddening, and -rosetting, and the production of aerial tubers in the axils of the leaves. The greatest percentage of plants showing purple top resulted from inoculation with *F. avenaceum*, some from *F. oxysporum*, and only a few from *F. solani* var. *eumartii*.

Blodgett (F. M.). **A method for the determination of losses due to diseased or missing plants.**—*Amer. Potato J.*, xviii, 5, pp. 132–135, 1941.

Stewart (*Bulls. N.Y. St. agric. Exp. Sta.* 459, pp. 45–69, 1919; 489, pp. 1–52, 1921) and Livermore (*J. Amer. Soc. Agron.*, xix, pp. 857–895, 1927) have shown that in the case of potatoes, the adjacent hills on either side of a missing one make up about a quarter of the loss in yield of missing hills, or together the hills on both sides offset about half the reduction. This raises the question whether the low yield of a potato plant affected by a virus disease, e.g., leaf roll, may not be partially counterbalanced by adjoining healthy hills. Following up a suggestion by H. K. Fernow, an attempt (which is described and illustrated by hypothetical examples) has been made to work out a method for the determination of losses from diseased or missing plants by the classifications of the hills in a field into six classes, H(ealthy)HH, HD(iseased)H, DHH or HHD, DHD, DDH or HDD, and DDD, in relation to the effect of adjacent hills on the central one and the computation of the frequency of such classes in fields with varying disease percentages by a modification of the binomial distribution system.

Tuthill (C. S.) & Decker (P.). **Losses in yield caused by leaf roll of Potatoes.**—*Amer. Potato J.*, xviii, 5, pp. 136–139, 1941.

The method devised by Blodgett for the determination of the losses in yield caused by diseased or missing plants in rows of field potatoes [see preceding abstract] was applied to two varieties, Chippewa and Cobbler, affected by leaf roll to the extent of 35 and 23 per cent., respectively, on peat soil near Elba, New York. It was found that the healthy hills bordered by diseased ones on one or both sides partially compensated for the reduction in yield due to infection. Since the yield varies with changes in the percentage of diseased plants, the binomial distribution may be used to estimate the frequency with which healthy plants will occur with those affected by leaf roll on one or both sides. There is thus a basis for the computation of loss in yield for any percentage of disease by ascertaining the output of the central plants in the six classes differentiated. The method under trial would appear to be equally well adapted to statistical studies on other tuber-transmissible diseases.

Yoshii (H.). **Studies on the nature of Rice blast resistance. I. The effect of silicic acid to the resistance. II. The effect of combined use of silicic acid and nitrogenous manure to the toughness of the leaf blade of Rice and its resistance to Rice blast. III. Relation between Rice blast resistance and some physical and chemical properties of the different portions of the leaf blade of Rice.**—*Bult. sci. Fak. terk. Kjuŝu Univ.*, ix, 3, pp. 277–307, 1941. [Japanese, with English summaries.]

In the writer's fully tabulated studies to determine the relation of

the toughness of the leaf blade and its silica content to the susceptibility to rice blast (*Piricularia oryzae*) [*R.A.M.*, xix, p. 429] of plants grown in Kasugai's solution made up with tap water containing 13·3 mgm. silicic acid per l., the cultures were divided into four series and supplied with 0, 50, 250, and 500 mg. silicic acid per l., respectively. The toughness of the leaf blade was measured by the needle puncture method, using Joly's balance, at the motor cell region of the inner half of the blade, the resulting data being expressed in gm. weight per sq. mm. By these means it was ascertained that the resistance of the leaf blade to *P. oryzae* and its silica content, but not its toughness, increase in proportion to the quantity of silicic acid supplied.

The application of silicic acid to the soil was shown to enhance the resistance of rice to blast, while foliar toughness, measured by the needle puncture or tearing method, varied in inverse proportion to the amount of nitrogenous manure given. Where the latter factor is maintained at a uniform level, the percentage of silica in the leaves of plants receiving silicic acid exceeds that in the foliage of plants from which this element was withheld. Under similar conditions, the toughness of the leaves of plants to which silicic acid is applied is less than that of the untreated series.

The toughness and the percentages of silica and nitrogen were measured in the apical, middle, and basal regions of rice leaf blades, two resistant varieties, Sensyō and Aikoku, and three susceptible, Asahi, Ban-Shinriki, and Kamairazu, being included in the tests for toughness, while Totigi-Wase and Tōgō were used in the ripening stage for the silica and nitrogen determinations. The resistance of the leaf blade to needle puncture was found to be highest at the base and lowest near the tip, while the percentages of silica and nitrogen were largest in the apical and basal regions, respectively. Comparing these data with those secured by T. Abe [ibid., xvii, p. 767], it is apparent that the susceptibility of rice leaves to blast is proportionate to the amount of nitrogen and inversely proportionate to that of silica in the blades, but that little or no connexion exists between reaction to *P. oryzae* and the toughness of a given area of the leaf.

Nakata (K.) & Takimoto (S.). **A ring strain of Tobacco common mosaic found on the Pepper.**—*Bult. sci. Fak. terk. Kyuŝu Univ.*, ix, 2, pp. 178–189, 14 figs., 1940. [Japanese, with English summary.]

A ring strain of mosaic observed on the Sisi-togarasi [chilli] pepper variety in nature produces a large, bright yellow mottling on the leaves, and in inoculation experiments the Nikko and Takanotume varieties likewise reacted by distinct ring or mottle patterns, while in the case of Yatuhusa and Okinawazairai primary local necrotic spots were formed on the inoculated leaves and those produced subsequently were normal. Primary necrotic lesions also developed on the inoculated foliage of *Datura stramonium*, *Nicotiana glutinosa*, *N. repanda*, and *N. longiflora*, a bright yellow mottling on the young leaves of two or three other Solanaceae, and distinct rings on tobacco, *N. glauca*, and *Solanum sisymbrifolium*. The virus retains its infectivity at 1:100,000 but not at 1 in 1,000,000, and is inactivated by ten minutes' exposure to 90° C. The virus is considered to be a distinct strain of tobacco mosaic (*Nico-*

*tiana* virus 1) [*R.A.M.*, xx, p. 402], characterized by the production of definite rings on tobacco and a yellow mottling on *Physalis angulata* and *S. nigrum*.

COCHRAN (H. L.). **Better methods of Pimiento production.**—*Bull. Ga Exp. Sta.* 218, 41 pp., 27 figs., 1941.

The section on diseases (pp. 27–39) of pimiento [chilli] and their control in Georgia is an abridgement of a paper by B. B. Higgins entitled 'Important diseases of Pepper in Georgia', reference to which has already been made [*R.A.M.*, xiv, p. 344].

SAINT (S. J.). **Report on the work of the Department of Science and Agriculture, Barbados, for the year ending 31st March, 1940.**—14 pp., [1941].

During the period under review, routine inspections of the sugar-cane crop in Barbados were carried out until the growth made adequate inspection for mosaic [*R.A.M.*, xix, p. 494] no longer possible. Heavy infection was discovered in the tenantries at Cleavers Hill, St. Elizabeth's Village, St. Joseph and Workman's tenantry, St. George, and these localities, together with Orange Hill Tenantry, St. James, were added to the 'Proclaimed Infected' areas. During the planting season, growers in the 'proclaimed infected' districts were supplied with mosaic-free cane as usual, the resistant B. 35187 variety being distributed wherever possible.

RAMAKRISHNAN (T. S.). **Top rot ('twisted top' or 'pokkah bong') of Sugarcane, Sorghum, and Cumbu.**—*Curr. Sci.*, x, 9, pp. 406–408, 2 figs., 1941.

In 1940, at the Coimbatore Agricultural College and Research Institute, *Fusarium moniliforme* [*Gibberella fujikuroi*] was isolated from the tissues of sugar-cane affected by top rot [*R.A.M.*, xix, p. 583], sorghum showing symptoms of twisted top [ibid., xiv, p. 472], and *Pennisetum typhoides* suffering from a similar disorder. The upper leaves of the diseased sorghum plants were linked together, forming a series of arches, the tips of the younger leaves being rolled inside those of the older ones; the upper nodes were shortened, and earheads were usually abortive. The three isolates were grown on French bean and Quaker oats agars and steamed rice, the two last-named media being coloured varying shades of purple by the growth of the organisms. Cross-inoculation experiments with the three strains of the fungus gave positive results on all the above-mentioned hosts, but not on rice. The differences between the sorghum disease of Coimbatore and the twisted top of sugar-cane in Cuba, said to be caused by mechanical friction [ibid., viii, p. 670], are briefly discussed: the latter occurs more severely in dry periods and is not associated with rotting, whereas the former develops only during the rainy months and is accompanied by discoloration and rotting. Moreover, *G. fujikuroi* is consistently present in the diseased sorghum, while both in this host and in *P. typhoides* the symptoms are more akin to those of 'pokkah-boeng', caused by *G. fujikuroi*.

RAMAKRISHNAN (T. S.). **Studies in the genus Colletotrichum. II. Physiological studies on Colletotrichum falcatum Went.**—*Proc. Indian Acad. Sci.*, Sect. B, xiv, 4, pp. 395–411, 1 pl., 2 figs., 1941.

Continuing his studies on the genus *Colletotrichum* [*R.A.M.*, xx, p. 317] at the Coimbatore Agricultural Research Institute, the writer made a series of observations on the development in pure culture of *C. falcatum*, isolated from Poovan sugar-cane in Madras [ibid., xix, p. 259]. The pathogen grows well on a number of standard media, including French bean, Quaker oats, and Richards's agars, the optimum hydrogen-ion concentration and temperature for its development being $P_H$ 4·5 to 5 and 32° C., respectively. The average spore length ranged from 19·9 $\mu$ to 27·6 $\mu$ (the normal size) at 15° and 30°, respectively. The spores are destroyed by five minutes' exposure to a temperature of 51°. Sucrose was found to be the best source of carbon, while nitrogen is most readily assimilated from asparagin, potassium nitrate, and peptone, the maximum amount of growth being made at a carbon-nitrogen ratio of 5:1. On a medium supplying ammonium sulphate as the nitrogen source the spores produced show a bulge in the middle or are otherwise malformed, whilst on one supplying asparagin the spores are shorter than on a potassium nitrate medium.

A pale-coloured saltant, developing on Richards's agar, differed in certain respects from the dark parent race [ibid., xx, p. 228]: for instance, its maximum virulence was exerted in inoculation experiments at 34° instead of 30°, it attacked the Co. 213 variety less, and Co. 421 more, severely than the dark parent, and the growth of the mutant was scantier at the optimum temperature than that of the original dark race. The pale saltant further proved to be more resistant than the dark race to the encroachment of *Trichoderma lignorum* [*T. viride*] in paired cultures, and there were also variations in the extent of enzyme production, the dark race yielding more diastase and pectinase and the light one more trypsin, amidase, and erepsin; the latter, moreover, forms small quantities of emulsin, which is not produced by the parent.

WATERSTON (J. M.). **Observations on parasitism of Rosellinia pepo Pat.**—*Trop. Agriculture, Trin.*, xviii, 9, pp. 174–184, 10 figs., 2 diags., 1941.

*Rosellinia* spp. causing root disease in the West Indies [*R.A.M.*, xiv, p. 84] are stated to be confined to *R. bunodes*, which was isolated from *Hibiscus rosa-sinensis* and grapefruit from Grenada and from arrowroot from St. Vincent, and *R. pepo*, isolated from cacao in Trinidad and Grenada and from nutmeg in Grenada, while *R. paraguayensis* was found on only one occasion on a badly pruned branch of an otherwise healthy cacao tree and is not considered to be parasitic. No perfect stage of *R. pepo* was observed, whereas perithecia of *R. bunodes* were abundant. The rarely produced perithecial stage is stated to be the main character distinguishing *R. pepo* from *R. paraguayensis*, while the following differences exist between the former fungus and *R. bunodes*: in *R. pepo* the mycelial fan encircling the collar of the stem is brown or purplish black with an olive-green tint; on the roots the fungus produces loose, cobweb-like strands, at first smoky grey, later black and coalescing

into a carbonaceous mass with a woolly or glossy felt-like surface; in the tissues it forms white irregular strands in the cortex, white fans or star-like webs in the cambium, no strands, but thin plates appearing in cross section as black zig-zag lines in the wood, and firm, round, buff-coloured strands with a white centre in the herbaceous stems. In *R. bunodes* the mycelial sheet encircling the collar is white at first, later purplish-black; on roots the mycelium appears as closely applied, firm, black, branching strands with thicker irregular knots; in the tissues *R. bunodes* forms cylindrical strands, black outside and white inside the cortex, black thread-like strands on the surface of the wood, colourless mycelium and later black strands within the wood, and round, black strands in the herbaceous stems. On 2 per cent. malt agar, colonies of *R. pepo* are dark brown and glossy at first, later woolly and olive green, the white mycelial strands turning black with age, while the colonies of *R. bunodes* are white and woolly at first, later turning buff-coloured, the mycelial strands being black.

*Rosellinia* attacks were observed in two widely different types of area: in regions of high rainfall and little sunshine, with abundant humus, the fungus spreads without restriction, either living saprophytically on decaying leaf mould or acting as a dangerous although incidental parasite; in regions with low rainfall, absence of shade trees, and poor humus formation, the spread of the fungus is slow and confined to roots of susceptible hosts. The list of hosts of *R. pepo* comprises 16 species. This fungus is stated to have a more restricted range and geographical distribution than *R. bunodes*. Field and laboratory observations showed that hydrogen-ion concentration, amount of nitrogen, organic matter, available potash and phosphate, and the rate of nitrification in the soil within or adjacent to disease patches had no relation to the incidence of *R. pepo* in cacao estates. A deficiency in available phosphate (below 40 p.p.m.) was, however, common to all disease patches. Field evidence indicated that *R. pepo* preferred soils of light texture, and it was shown experimentally that the rate of infection of cacao seedlings was most rapid in the drier and better aerated series. The pathogenicity of *R. pepo* to both young and mature cacao trees was demonstrated by inoculation experiments in the field as well as in the laboratory, and it is concluded that the fungus is a primary parasite of cacao.

SYDOW (H.). **Fungi aequatorienses. (Series prima.)** [Ecuadorian fungi. (First series.)]—*Ann. mycol., Berl.*, xxxvii, 4–5, pp. 275–438, 1939. [Received January, 1942.]

This critically annotated list of fungi (including a number of new species) collected by the author on the occasion of a six months' visit to Ecuador commencing in August, 1937, is preceded by a foreword describing the climatic, topographical, and ecological features of the country in relation to its fungus flora, and by a five-page bibliography of papers dealing with the latter. The following are among the species of economic importance listed: *Uromyces janiphae* on cassava, *Puccinia maydis* on maize, *Tranzschelia* [*P.*] *pruni-spinosae* on *Prunus capula* var. *salicifolia*, *Phyllachora gratissima* on avocado [*R.A.M.*, xxi, p. 99], *Mycosphaerella brassicicola* on cabbage, *Aphanopeltis aequatoriensis*

n.sp. on *Pithecolobium* [*Samanea*] cf. *saman*, *Asperisporum caricae* on papaw [ibid., xxi, p. 88], and *Cercospora nicotianae* on tobacco.

SYDOW (H.) & AHMAD (S.). **Fungi panjabenses.** [Punjab fungi.]—*Ann. mycol., Berl.*, xxxvii, 4–5, pp. 439–447, 1939. [Received January, 1942.]

Included in this critically annotated list of fungi (comprising a relatively large number of smuts) collected by the junior author in the plains of the Punjab are a new genus (*Ahmadia*) and eight new species.

THOM (C.) & RAPER (K. B.). **The Aspergillus glaucus group.**—*Misc. Publ. U.S. Dep. Agric.* 426, 46 pp., 14 figs., 1941.

A study embracing comparative culture and microscopic examination of strains of the *Aspergillus glaucus* group in the authors' collection (made over a period of 35 years) [*R.A.M.*, v, p. 700], supplemented by strains and groups of strains from numerous other sources, enabled all these strains to be brought together into a series of aggregate species, each characterized by the production of ascospores within a particular size range and bearing typical markings.

The species aggregates recognized are *A. repens*, *A. ruber*, *A. chevalieri*, *A. amstelodami*, *A. minor*, *A. umbrosus*, *A. echinulatus*, *A. medius*, *A. carnoyi*, and *A. niveo-glaucus* n.sp., for each of which a type is described. The additional species and varieties recognized are *A. pseudoglaucus*, *A. chevalieri* var. *intermedius*, n. var., and *A. montevidensis*, within the *A. repens*, *A. chevalieri*, and *A. amstelodami* aggregates, respectively. The usages represented by strains received under particular names in culture are tabulated to show their place in the arrangement of species proposed. Forms showing the ascospores of a series, but differing in colony morphology and details of activity, are regarded as variants, not taxonomic varieties.

In the course of a discussion on variation in this group the authors report observations on type cultures of B. Barnes's mutants of *Eurotium herbariorum* [ibid., viii, p. 192]. They identify the original normal strain as *A. amstelodami*, and four of the 'variants' as *A. ruber*, *A. repens*, *A. chevalieri* var. *intermedius*, and *A. ustus*, and suggest that they may have appeared in Barnes's cultures as contaminations. A fifth variant is of the *Cladosarum* type. It is suggested that Yuill's genus *Cladosarum* represents a monster type unlikely to survive in nature, and that it is therefore doubtful whether generic designation is warranted.

PETCH (T.). **Further notes on British Hypocreales.**—*Trans. Brit. mycol. Soc.*, xxv, 2, pp. 166–178, 1941.

In this paper the author adds 27 species in 15 genera to his list of British Hypocreales [*R.A.M.*, xvii, p. 772]. He points out that Tulasne first found his *Nectria ditissima* on beech, and stated that it was *N. coccinea*, and that to it belonged at least in part the *Sphaeria coccinea* of most mycological writers. Phillips and Plowright recorded *N. ditissima* in New and Rare British Fungi, No. 154, March, 1880, but Plowright's paintings of the fungus on canker in apple trees, now in Herb. Brit. Mus., are of *Dialonectria galligena*.

A specimen of *D. galligena* on ash was received by the author from Wells, Somerset (April, 1938).

Only one British specimen of *Gibberella zeae* [usually known by plant pathologists as *G. saubinetii*: ibid., xiii, p. 154; xix, p. 117] (on grains of wheat) was cited in the author's first paper. In Grove's herbarium there is a specimen on the culm of an undetermined grass. Probably the fungus is not uncommon on native grasses. Specimens have been received on *Phragmites* (Norfolk, 1939).

Blackwell (E[lizabeth] M.), Waterhouse (G[race] M.), & Thompson (M. V.). **The invalidity of the genus Pythiomorpha.**—*Trans. Brit. mycol. Soc.*, xxv, 2, pp. 148–165, 2 figs., 1941.

A detailed study of a strain of '*Pythiomorpha gonapodyides*' found on an apple that had been dropped into a pond revealed its identity in pure culture with *Phytophthora megasperma*. A survey of the descriptions of different forms and species of *Pythiomorpha* recorded between 1909 and 1936 showed that each would answer to a species of *Phytophthora* growing in water. The descriptions of the original species, *Pythiomorpha gonapodyides*, varied widely enough to suggest they might apply to more than one species of *Phytophthora*. Investigation of the features claimed as diagnostic for the genus *Pythiomorpha* (proliferating sporangia, emission of zoospores within a vesicle, irregular hyphae, cellulin grains, absence of conidia, diplanetic zoospores, and aquatic habitat) showed that all of these were equally characters of the Pythiaceae as a whole and all are present in *Phytophthora megasperma* (except the variable cellulin grains). There are, therefore, no grounds for retaining the genus *Pythiomorpha*. The recommendation is made that no further species of *Pythiomorpha* should be erected. The five species already described should be re-examined, and if not found to be known species of *Phytophthora* (or *Pythium*) should be incorporated as new species into one or other of these genera.

Marudarajan (D.). **Observations on the production of sexual organs in paired cultures of Phytophthora species of the palmivora group.**—*Proc. Indian Acad. Sci.*, Sect. B, xiv, 4, pp. 384–389, 1 pl., 1941.

At the Agricultural Research Institute, Coimbatore, the author studied the production of oospores in paired cultures on standard media at 20° C. of three isolates of *Phytophthora palmivora* from *Borassus flabellifer*, coco-nut, and orange, respectively, and one each of *P. arecae* from areca palm, *P. faberi* [*P. palmivora*] from cacao, and *P. meadii* from rubber. *P. arecae* formed oospores in combination with *P. meadii* and *P. palmivora* (all strains) and thus falls into Gadd's 'rubber group' of *P. palmivora*, while *P. meadii* behaves as a member of the 'cacao group' [*R.A.M.*, vi, p. 608] thereby invalidating Ashby's tentative relegation of *P. arecae* and *P. meadii* to a single species [*P. arecae*] separable by their mode of development in culture into two groups of strains, *arecae* and *meadii* [ibid., ix, p. 272]. The formation of oospores in mixed cultures of *P. arecae* with *P. meadii* or any of the members of the cacao group affords additional grounds for merging all these isolates as strains of *P. palmivora*, as suggested by Tucker [ibid., x, p. 755].

Ainsworth (G. C.). **A method for characterizing smut fungi exemplified by some British species.**—*Trans. Brit. mycol. Soc.*, xxv, 2, pp. 141–147, 1941.

A description is given of a shorthand method devised by the author for recording the principal characters of the smut fungi. It consists in a numerical formula in which the first four numerals (A) represent macroscopic characters (or characters that require only supplementary microscopic examination), the second four (B) microscopic characters, and the third four (C) measurements, the requisite numeral for each character being selected by reference to a given table. The four numerals in A represent, respectively, the position, covering, and internal structure of the sorus, and the macroscopic appearance of the spore mass; those in B, the microscopic appearance of the spore mass, whether the spores are single, in pairs, or in balls, spore ornamentation, and spore coloration; while the C figures represent, respectively, the mean maximum spore diameter in $\mu$, the mean maximum spore-ball diameter in $\mu$, the mean sorus length in cm., and the mean maximum diameter of sterile cells, sterile spores, cells of false membrane, sterile cortical cells of spore ball, or conidia of an *Entyloma* in $\mu$. A table is given showing the numeral to be selected for each character and the application of the formula to *Sphacelotheca cruenta* and *S. sorghi* is explained. These species are represented by the formulae 1112·2102·2014 and 1112·½102·1012, respectively. Formulae for 45 British smuts are appended.

Simura (T.). **Further studies on the resistance to brown blight in Tea plants.**—*Jap. J. Genet.*, xvi, 5, pp. 246–256, 8 graphs, 1940. [Japanese, with English summary.]

Analyses of the leaves of tea plants giving varying reactions to infection with the brown blight fungus (*Guignardia camelliae*) [*R.A.M.*, xix, p. 45] showed that resistant types contained more tannin and less nitrogen than susceptible types. As was to be expected from these relationships, the growth of the pathogen was to a great extent inhibited in Hopkins's medium prepared with juice from the leaves of resistant varieties, whereas a stimulus to its development was afforded by the foliar extract from susceptible sorts. Caffein, like tannin, tended to retard the growth of *G. camelliae*, but the amount of the former substance in tea leaves is relatively small.

Allington (W. B.). **Observations on the epidemiology of Tobacco wildfire and blackfire.**—*Phytopathology*, xxxi, 10, pp. 957–959, 1 fig., 1941.

In recent tests at the Wisconsin Agricultural Experiment Station, light was found to be an important factor in the development of physiological water-soaking of tobacco plants, which has been shown to provide a suitable condition for infection by the wildfire and blackfire organisms (*Bacterium tabacum* and *Bact. angulatum*) [*R.A.M.*, xvii, p. 205]. Thus, plants grown in a sandy soil in the greenhouse and transferred to a moisture-laden atmosphere developed typical and profuse foliar water-soaking in darkness or subdued light, higher intensities of which, on the other hand, prevented the occurrence of

the condition under comparable temperature and humidity conditions. Both pathogens have been found to survive for periods up to six months in the leaves of the atypical hosts lucerne, bean (*Phaseolus vulgaris*), *Ambrosia bidentata*, and *Chenopodium album*, as well as in tobacco itself, so that the organisms could overwinter and be disseminated in such material.

Elrod (R. P.) & Braun (A. C.). **A phytopathogenic bacterium fatal to laboratory animals.**—*Science*, N.S., xciv, 2448, pp. 520–521, 1941.

*Phytomonas polycolor*, the agent of a tobacco leaf spot in the Philippines [*R.A.M.*, x, p. 133], has been found by the authors to be extremely virulent when injected into laboratory animals, mice and guinea-pigs dying within 12 and rabbits in 24 hours. The evidence so far available indicates that the organism is probably the same as *Pseudomonas aeruginosa* (Schroeter) Migula.

Henderson (R. G.). **Treatment of Tobacco plant bed soil with nitrogenous fertilizers.**—*Agric. News Lett.*, *1941*, 9, pp. 72–78, 1941. [Abs. in *Chem. Abstr.*, xxxv, 22, p. 8187, 1941.]

In connexion with an experimental project on the response of tobacco seed-beds to nitrogenous fertilizers, evidence was secured that the agent of black root rot, *Thielaviopsis basicola*, can be effectively combated by the application of urea to the soil at the rate of ½ lb. per sq. yd.

McClean (A. P. D.). **Some leaf-curl diseases in South Africa. (i) Leaf-curl disease of Tobacco. (ii) A new 'Petunia'-strain of leaf-curl and a note on the occurrence of a leaf-curl disease of Hollyhock.**—*Sci. Bull. Dep. Agric. S. Afr.* 225, 72 pp., 14 pl., 1 fig., 1940.

Leaf curl of tobacco [*R.A.M.*, xix, p. 196] is stated to be now recorded in most parts of Africa where this crop is grown. In the present studies, commenced at the Natal Herbarium in 1931, the disease was transmitted by means of white fly, *Trialeurodes natalensis*, to tobacco, *Datura stramonium*, tomato, currant tomato (*Lycopersicum pimpinellifolium*), *Nicotiana glutinosa*, *Nicandra physaloides*, and possibly also to *Physalis peruviana*, *Helichrysum monstrosum*, and *Zinnia elegans*. It was also transmitted by grafting between tobacco and various Solanaceous hosts, but not by mechanical inoculation or through the seed of tobacco or *D. stramonium*. During the process of transmission of the virus from plants with severe leaf curl, apparently weaker strains of virus arose, which produced milder symptoms on tobacco and other hosts. These new strains were designated as mild and latent, of which 7 and 17, respectively, were isolated; the former were distinguished by their ability to produce enations, whilst the latter are incapable of causing any thickening or enations on the leaves of tobacco. Two main types of reaction were found associated with the typical or severe form of leaf curl disease, their extent varying with the different hosts. The first response of tobacco is the development of a brilliant yellow network on the upper surface of the young leaves coinciding with the veins, and is formed by partial chlorosis as a preliminary response to

invasion by the virus. It appears to correspond with clearing of the veins and is highly diagnostic. The second type of reaction, developing to the greatest extent in tobacco, leads to the formation of enations, which either take the form of small, dark green, thickened areas or of comparatively large leafy outgrowths on the veins of the lower surface of the leaves. Of the anatomical changes in the leaf associated with the disease, the more important are hyperplasia in the pericycle and the development of palisade tissue towards the lower surface.

A new form of leaf curl was observed in 1939 on petunias in the Durban Botanical Gardens [ibid., xx, p. 150]. It was transmitted by grafting to tobacco, *Nicotiana glutinosa*, tomato, and petunia. It was readily distinguished from the leaf curl in tobacco, the main points of difference being the failure to induce a yellow network or any form of chlorosis in the early stages of infection in all the above-mentioned hosts; the continuous type of enations on tobacco leaves; the excessive distortion of tobacco leaves; the well-marked enations on *N. glutinosa* and tomato; the development of petal-like outgrowths on the corolla tube of petunias; and failure to infect *Datura stramonium*.

During the same year a leaf curl disease was also observed in hollyhock at Durban [loc. cit.], but no transmission trials were made and the relationship of this disease to other forms of leaf curl is not known.

McKinney (H. H.). **Virus antagonism, host resistance, and the acquired-immunity concept with reference to plants.**—*Phytopathology*, xxxi, 11, pp. 1059–1061, 1941.

The writer's studies on tobacco ring spot have confirmed Valleau's conclusion that affected plants do not outgrow the disease [*R.A.M.*, xx, p. 600], which merely passes from the acute phase, represented by ring spots, lesions, and oak leaf patterns, to a less apparent chronic condition in the subsequently invaded leaves. The infected plants, as in Valleau's experiments, gave poor yields, but the diffuse chlorosis observed by him at low temperatures, and a mottled and necrotic spot form of the same reaction, developed only in the growing leaves of certain varieties provided with ample quantities of fertile soil. The persistence of acute symptoms was shown to be favoured by the application of large amounts of virus to the developing leaves of plants that have entered the period of maximum growth rate. In some early-maturing selections treated in this way up to 70 per cent. of the plants manifested acute symptoms in all the leaves appearing after the onset of the disease, whereas in young seedlings inoculated before the rapid growth phase, only one to four leaves ordinarily showed acute signs of disease, and few or no local or systemic symptoms developed when the virus was wiped on slow-growing foliage with a thick, leathery texture.

The term 'acquired immunity' is thought to have been widely misinterpreted of recent years, and in connexion with Price's three types of this phenomenon, viz., chronic disease, carrier, and sterile [ibid., xx, p. 74], it is proposed that the third only be retained, at any rate by phytopathologists, for those cases in which a given virus or other infectious agent is incapable of multiplication in a plant. Symptomless carriers and mild reactors represent degrees of resistance,

tolerance, or susceptibility, because it is highly improbable that carriers are entirely free from symptoms.

KASSANIS (B.) & SHEFFIELD (F. M. L.). **Variations in the cytoplasmic inclusions induced by three strains of Tobacco mosaic virus.**—*Ann. appl. Biol.*, xxviii, 4, pp. 360–367, 2 pl., 1941.

Several new types of cytoplasmic inclusions were observed at Rothamsted in 1940 and 1941 in glass-house tobacco, tomato, and *Solanum nodiflorum* plants infected with each of three strains of tobacco mosaic virus: the ordinary tobacco mosaic, aucuba, and enation mosaic viruses [cf. *R.A.M.*, xxi, p. 61]. The new forms, mostly fibrous, included spindle-shaped bodies, masses of short needle-like fibres, and extremely long fibrous coils. The spike-like body, which had not been noted for a number of years, was again observed, and new amorphous forms were also found. All these arose either directly or from pre-existing inclusions of types previously recorded. The observed variations are not considered to be due to mutation of the virus strain, as almost identical results were obtained from all three strains. The type of inclusion produced appears to be to some slight extent determined by the host plant, but chiefly influenced by the amount of light and heat available to the host.

COHEN (S. S.). **Separation of Tobacco necrosis virus and Tobacco mosaic virus.**—*Proc. Soc. exp. Biol., N.Y.*, xlviii, 1, pp. 163–167, 2 graphs, 1941.

In the course of a study on the properties of the tobacco necrosis virus, occasional batches of Turkish tobacco plants were encountered which showed not only the non-systemic symptoms of necrosis on the lower inoculated leaves, but also through contamination those of systemic mosaic infection. Since the yield of the tobacco mosaic virus may amount to 2 to 3 mg. per c.c. juice [*R.A.M.*, xvii, p. 206], or over 100 times that of tobacco necrosis, which averages, according to unpublished data by Cohen and Stanley, 0·02 mg. per c.c., it was considered advisable to attempt the removal of the former.

This was effected by differential centrifugation with electrophoresis and by absorption with rabbit serum, precise descriptions of the methods used being given.

SPENCER (E. L.). **Influence of nitrogen supply on the rate of multiplication of Tobacco-mosaic virus.**—*Plant Physiol.*, xvi, 4, pp. 663–675, 1 fig., 2 graphs, 1941.

Further studies on the influence of nitrogen supply on tobacco mosaic virus in Turkish tobacco plants [*R.A.M.*, xx, p. 498], in which the plants (grown in sand) were supplied with nutrient solutions containing low, medium, and high amounts of nitrogen, showed that in young plants a difference in virus activity became apparent on the 5th day after inoculation. The juice expressed from low-nitrogen plants was only about 35 per cent. as active as that from those receiving more nitrogen; on the eighth day the figure was less than 25 per cent. By this latter date, the juice from the high-nitrogen plants contained 12 times more virus than that from the low-nitrogen plants, though the

former were only two or three times the size of the latter. From the 4th to the 12th day after inoculation, the virus-protein content of the juice expressed from the low-nitrogen plants increased about 20 times, while that of the juice from the high-nitrogen plants increased over 200 times.

Older affected plants given the medium-nitrogen solution for longer periods before receiving the high-nitrogen solution showed greater virus activity as a result of the extra supply of nitrogen. The evidence indicated that the larger the plant the longer the time taken for the increased nitrogen supply to become effective.

The evidence obtained is considered to support the view that the increased virus activity associated with increased nitrogen supply was due primarily to an increase in the rate of virus multiplication in the high-nitrogen plants and slightly, if at all, to the partial inactivation of the virus in the low-nitrogen plants. Increase in the rate of virus multiplication appeared to be correlated with the nitrogen supply itself, and not directly with a growth differential resulting from the nitrogen treatment. Possibly, even in small plants there may be only a limited supply of available nitrogen. In such cases, as with larger plants, the competition for the available nitrogen between the normal growth processes and those responsible for virus formation may be a limiting factor in virus multiplication.

Nakata (K.) & Takimoto (S.). **Studies on the 'yellow Tobacco mosaic' or 'aucuba mosaic' of Tomato.**—*Bult. sci. Fak. terk. Kyuŝu Univ.*, ix, 2, pp. 167–178, 1 col. pl., 10 figs., 1940. [Japanese, with English summary.]

The disease known as 'yellow tobacco mosaic' was experimentally shown to induce the same symptoms in tomato as aucuba mosaic, while the various properties of the virus under observation also coincide with those of *Nicotiana* virus 1c [tobacco virus 6]. Primary local lesions developed on inoculated leaves of *Datura stramonium*, *Nicotiana glutinosa*, and *N. sanderae*, while the new foliage of numerous other Solanaceae responded by yellow mottling. The aucuba mosaic virus proved to be very resistant to high temperature and chemicals, retaining its virulence for over a year in test tubes.

Richardson (L. T.). **A Phytophthora Tomato disease new to Ontario.**—*Canad. J. Res.*, Sect. C, xix, 11, pp. 446–483, 17 figs., 4 graphs, 1941.

Since 1937, tomatoes growing under glass in central Ontario have been severely affected by a damping-off of seedlings and a rot of stems, fruits, leaves, and roots caused by *Phytophthora parasitica* [cf. *R.A.M.*, xx, pp. 324, 501]. One outdoor crop in the same locality has also been affected, and in 1940 the disease was reported from the Okanagan Valley, British Columbia. Seedlings may be killed before, during, or after emergence, and 50 per cent. in a flat may succumb in one day. In older plants grown indoors the symptoms consist of collar rot, stem girdle, or stem canker. On staked greenhouse plants the lesions are always within a foot of the ground. Fruits near the ground develop

lesions having a dark brown centre surrounded by an advancing zone with a greyish, water-soaked appearance. Roots grown in infected soil show rotted portions with mycelium within the tissues.

On oatmeal agar the fungus formed sporangia and chlamydospores, and on the roots of an artificially inoculated tomato seedling, oogonia and oospores; full descriptions of these organs are given.

The minimum, maximum, and optimum growth temperatures of the fungus on oatmeal agar were, respectively, about 12°, 32·5°, and 26° to 32·5° C., but on maize meal agar the optimum was 18° to 21°. No aerial growth took place at relative humidities under 80 per cent. Above this figure, colony size increased with increasing humidity up to saturation. Growth was possible at $P_H$ 3·5 and 9·5, while maximum growth occurred (under the conditions of the experiment) at $P_H$ 5.

Experimental evidence further demonstrated that infection was favoured by high atmospheric temperature and high relative humidity. Incidence varied directly with soil moisture content, and reached a maximum at soil temperatures in the vicinity of 22°. The ability of the fungus to establish itself in a soil depends upon the type of soil, the other micro-organisms present, and the substrate available for saprophytic development. Invasion of non-infested soils was retarded by the competitive factor and accelerated by the presence of living roots of tomato seedlings. The activity of the pathogen was suppressed by the addition of soy-bean residue to infested soil.

Natural infection was observed only on tomatoes, but inoculation tests revealed a wide range of potential hosts, almost all belonging to the Solanaceae. Over 40 commercial tomato varieties showed complete susceptibility to stem infection. A number of species of *Lycopersicum* were susceptible in the leaves, but the stems of some were resistant. The reaction of various Solanaceae and other plants is also given.

Control consists in the development of resistant tomato varieties, improved sanitation, crop rotation, and soil disinfection.

KAWAMURA (E.). **Bacteriophage of Bacterium solanacearum.**—*Bult. sci. Fak. terk. Kyuŝu Univ.*, ix, 2, pp. 148–156, 1 pl., 1940. [Japanese, with English summary.]

A bacteriophage of high potency was isolated by 15 successive filtrations from a culture on potato dextrose solution of *Bacterium solanacearum* [*R.A.M.*, xvii, p. 303], which inhibited the growth of the pathogen at a dilution of $10^{-10}$, its action being restricted, however, to the particular culture of the organism from which it was derived. Tomato plants were experimentally protected against the bacterial wilt by the incorporation of the bacteriophage in the soil. Two distinct strains of the bacterium were recognized, one forming circular, homogeneous colonies on potato agar and not liquefying gelatine, and the other developing irregular, fluid, non-homogeneous colonies and liquefying gelatine, the presence of the bacteriophage being confined to the latter type. The homogeneous strains of *Bact. solanacearum* developed in old cultures of the fluid type or those enriched with the bacteriophage, as well as in the lesions on tomato plants inoculated with the fluid strain, whence it is inferred that the latter may be a variation induced by the action of the bacteriophage.

ISRAILSKI (W. P.) & ARTEMIEVA (MME S. S.). **Serologische Untersuchungen der durch die Bakteriose befallenen Pflanzen. III. Untersuchungen der Tomaten auf Aplanobacter michiganense.** [Serological studies on plants attacked by bacteriosis. III. Examination of Tomatoes for *Aplanobacter michiganense.*]—*Микробиол.* [*Microbiol.*], x, pp. 74–80, 1941. [Abs. in *Chem. Zbl.*, cxii (ii), 19, p. 2335, 1941.]

The serological (precipitation) method was found in the writers' studies at the Central Quarantine Laboratory, Moscow [cf. *R.A.M.*, xix, p. 73], to give the most reliable and rapid results in the diagnosis of *Aplanobacter michiganense* on tomatoes [ibid., xviii, p. 422]. In the examination of 314 strains of pure cultures of various bacteria, including 147 of *A. michiganense*, the precipitation technique gave 96·2 per cent. indisputably correct results, 3·2 per cent. doubtful, and 0·6 per cent. erroneous; in the case of healthy and diseased plant extracts 10 per cent. of the precipitation reactions were doubtful and 2·4 per cent. incorrect, compared with 82 per cent. correct with the use of the Gram stain. Bacterial antigens from infected tomato plants should be prepared at 60° C. in a period of 30 minutes.

BEWLEY (W. F.). **Tomato Vetomold.**—*Gdnrs' Chron.*, Ser. 3, cx, 2868, p. 220, 1941.

Full particulars are given of the growth habit and other characteristics of the Vetomold tomato variety, reference to the outstanding resistance of which to leaf mould (*Cladosporium fulvum*) in England has already been made [*R.A.M.*, xx, p. 437; and above, p. 122]. The seeds of the new variety, which is the offspring of a cross between the red currant tomato (*Lycopersicum pimpinellifolium*) and the Potentate variety, were first received at the Cheshunt Research Station from the Ontario Horticultural Experiment Station in 1939, and further supplies were received in 1940 and distributed among 95 growers throughout the country. The reports so far to hand concerning the performance of Vetómold are uniformly encouraging.

WAGER (V. A.). **Blossom-end rot of Tomatoes.**—*Fmg S. Afr.*, xvi, 188, p. 375, 1 fig., 1941.

A brief account is given in popular terms of blossom-end rot of tomatoes [*R.A.M.*, xix, p. 169] and of its control by suitable cultural practices.

CONNERS (I. L.), MCCALLUM (A. W.), & BIER (J. E.). **Willow blight in British Columbia.**—*Phytopathology*, xxxi, 11, pp. 1056–1058, 1 fig., 1941.

Although willow [*Salix*] blight has been known in the eastern United States and Canada for over a decade, the present report (1940) appears to be the first of its occurrence in British Columbia, where *Physalospora miyabeana* was observed on twig cankers collected at Abbotsford in both the perithecial and conidial stages, while *Fusicladium saliciperdum* was also identified in one specimen received [*R.A.M.*, xviii, p. 827]. An examination of the affected trees *in situ* revealed cankers 2 to 4 cm. long on twigs 2 to 7 mm. in diameter, the girdling of which was followed

by the death of the terminal shoots and its foliage. The disease was first observed about three or four years ago. The 20-year-old tree bearing the heaviest infection and three smaller ones were destroyed, and no further foci of the disease were detected in the lower Fraser River valley or near Victoria. Opinions are divided as to the relative importance of *P. miyabeana* and *F. saliciperdum*, which are constantly associated, in the etiology of the blight; in the present instance the former predominated.

Fresa (R.). **Royas que atacan al Álamo híbrido italiano 'Arnaldo Mussolini' en el Delta del Paraná (Argentina).** [Rusts that attack the hybrid Italian Poplar 'Arnaldo Mussolini' in the Paraná Delta (Argentina).]—*Rev. argent. Agron.*, viii, 1, pp. 19–24, 2 pl., 2 graphs, 1941.

Early in April, 1938, grafts of the hybrid poplar 'Arnaldo Mussolini' (*Populus canadensis* × *P. nigra stella* I), imported from Italy and planted four months earlier in the Paraná Delta nursery, were observed to bear the uredosori of a rust, and in the following year there was a severe recurrence of infection, accompanied in this case by the teleutosori of a species of *Melampsora*, which also developed in 1940 on a new batch of imported grafts. A microscopic study of the diseased material revealed the presence of two rusts, of which one is referred to *M. larici-populina*, occurring in the Argentine on *P. nigra* var. *italica* [*R.A.M.*, xvi, p. 5; xvii, p. 83], and the other (tentatively) to *M. albertensis*, recorded by Dietel (*Rev. sudamer. Bot.*, iv, p. 80, 1937) from the Argentine and Uruguay on *P. carolinensis*. Both species belong to the partially smooth-spored group of *Melampsora*, echinulations being absent from the apex of the uredospores of *M. larici-populina* and from the middle of those of *M. albertensis*; the dimensions of the former species are 25·2 to 50·4 by 11·2 to 28 $\mu$ (mean length 36·4 $\mu$), and those of the latter 19·6 to 42 by 11·2 to 25·2 (28) $\mu$. The doubt as regards the identity of *M. albertensis* in the case under observation rests on the close similarity between this species and *M. medusae*, the average dimensions of the uredospores of which are 22 to 30 by 15 to 18 $\mu$, compared with 23 to 32 by 15 to 22 $\mu$ in *M. albertensis*, but the median thickening of the spores characteristic of *M. medusae* was not observed in the author's material.

Attempts should be made to control the rusts by the selection for propagation of highly resistant individuals of the hybrid.

Graves (A. H.). **Breeding work towards the development of a timber type of blight-resistant Chestnut: report for 1940.**—*Bull. Torrey bot. Cl.*, lxviii, 9, pp. 667–674, 1 fig., 1941.

In this progress report on chestnut breeding for resistance to blight [*Endothia parasitica*: *R.A.M.*, xx, p. 140] data are given of further hybrids made in 1940 at Hamden, Connecticut, and of the distribution of hybrids for testing to co-operative plantations in five of the eastern United States. Notes are also given on variation in *Castanea dentata*.

Davis (W. C.). **Damping-off of Longleaf Pine.**—*Phytopathology*, xxxi, 11, pp. 1011–1016, 1941.

The peculiar rosette-like habit of growth assumed by longleaf pine

(*Pinus palustris*) in its seedling and early sapling years entails certain departures from the norm in the symptomatology and etiology of damping-off, which in turn necessitate modifications in the ordinary methods of control. The initial phase of infection is characterized by water-soaking and a purplish discoloration of the cotyledon bases, the lower needles, and the hypocotyl of the seedling. The roots decay rapidly from the soil-line to a depth of $\frac{3}{4}$ in., while the remainder of the root system persists for so long as to indicate that organisms other than the primary invader are concerned in its disintegration. At a later stage the needles turn yellow, then brown, and droop. The rosette-like development of the seedling precludes the visible decay of the hypocotyl and collapse typical of damping-off in other pines, while another distinctive feature is that the agent or agents of the disease, which generally appear to enter at or just below the cotyledonary whorl, spread rapidly only in the tissues at or immediately beneath soil-level.

A species of *Rhizoctonia* was the most frequent isolate from diseased *P. palustris* seedlings in North and South Carolina nurseries and one in Mississippi between 1937 and 1940; affected nursery stock also occasionally yielded *Fusarium* and *Trichoderma* spp., while *Botrytis* sp. predominated in greenhouse tests.

The normal period of susceptibility to damping-off is considerably prolonged in the case of longleaf pine by its unusual growth habit. The most uniformly successful chemical control of the disease was obtained by sprinkling the seedlings with semesan at the rate of $\frac{1}{10}$ avoirdupois oz. to $\frac{3}{4}$ pt. water per sq. ft. seed-bed area, while in some tests ferrous sulphate and orthophosphoric acid, separately or combined at the time of sowing, gave promising results in some nurseries. In most nurseries the use of highly viable seed, sown in shallow rows and covered with $\frac{1}{4}$ in. layer of old sawdust, or broadcasted, firmed in the soil, and covered with sawdust, will probably afford the most practical methods of control. Cultural practices tending to keep the seedling bases free of soil should be adopted.

HADDOW (W. R.). **On the history and diagnosis of Polyporus tomentosus Fries, Polyporus circinatus Fries and Polyporus dualis Peck.**—*Trans. Brit. mycol. Soc.*, xxv, 2, pp. 179–190, 1 pl., 1941.

*Polyporus tomentosus*, *P. circinatus*, and *P. dualis* occur rather commonly in the coniferous forests of northern Ontario, where they cause a characteristic and destructive butt rot of their hosts, but correct diagnosis presents difficulty, owing to the existence of conflicting descriptions of these species. From an examination of authentic specimens and a comparative study of many collections from Europe and America, the author concludes that two closely similar forms exist, namely, *P. tomentosus* and *P. circinatus*, which are common to Europe and America. *P. dualis* is identical with *P. circinatus*. Both forms vary widely in size, habit, stratification of the context, depth of pore layer, and so forth, according to age and habitat, and cultural experiments showed that each comprises several strains differing in cultural characters. All the specimens studied exhibited a duplex structure. The relative thickness of the two layers varies, however, immensely. The lower stratum is hard, sometimes becoming vitreous when dried, and consists of more or less

straight, radiating hyphae. The upper stratum is soft, and composed of hyphae which, though derived from those of the inferior layer, are crooked, branched, and erect, the whole forming a loose, felty tomentum, often of considerable thickness. The typical difference between the forms lies in the shape of the setal elements of the hymenium, which in *P. tomentosus* are straight, and in *P. circinatus* strongly curved or hooked. As there is no other reliable diagnostic criterion, *P. circinatus* is considered to be a variety of *P. tomentosus* and is renamed *P. tomentosus* var. *circinatus* comb. nov. A revised description of the species is appended.

JOHNSON (J. W.). **Silver nitrate as a stain for use in studies of conduction of liquids in wood.**—*Phytopathology*, xxxi, 11, pp. 1035–1039, 2 figs., 1941.

A technique is described for staining green wood tissues to indicate clearly the pattern of primarily longitudinal liquid movements in wood. The stain solutions were injected into the wood block through a rubber tube fitted over the end, pressure causing a rapid flow of the stain through the wood. A 2·5 per cent. solution of silver nitrate in 20 per cent. ethyl alcohol proved to be the most effective of the stains tested. It was applied for two minutes, after which the sample was removed, split longitudinally, placed in elon-hydroquinone developer for 30 seconds, then in acid hypo for one minute, washed for ten minutes, and finally dried.

VERRALL (A. F.). **Dissemination of fungi that stain logs and lumber.**—*J. agric. Res.*, lxiii, 9, pp. 549–558, 1941.

Data collected over a period of ten years by the New Orleans Branch of the Division of Forest Pathology in Louisiana and Mississippi show that of the fungi causing stain in logs and timber [*R.A.M.*, xx, p. 388], *Ceratostomella pilifera*, *C. ips*, *C. pluriannulata*, *Endoconidiophora coerulescens*, *Graphium rigidum*, and *Diplodia natalensis* are disseminated by means of air currents and insects, the first five of these species by milling machinery, and *C. pilifera*, *C. ips*, *E. coerulescens*, and *D. natalensis* by the transport of infected wood. Rain water is probably of little importance since the wood inoculated by this means usually dries too rapidly for stain to develop. In well-constructed seasoning piles it does not penetrate to the interior of the piles where the most severe staining occurs. Although most staining fungi are disseminated by various means, *C. ips* and probably *C. pini* are chiefly carried by the bark beetles with which they are specifically associated. In discussing the relative importance of various means of dissemination, it is suggested that although air-borne spores are of less importance now than before chemical treatments were in common use, they still remain potentially important, as they may infect untreated timber or treated timber during prolonged wet periods when chemical treatments are less effective. Of the insects, only ambrosia beetles infecting hardwood logs and green timber of susceptible species, and bark beetles infecting pine logs, are of practical importance, as apparently none of the commercial stain-controlling chemicals in common use have any repellent effect on these two groups of beetles. Dissemination during the milling

process is considered of little importance owing to use of chemical treatments, but gains importance only when the timber is untreated. Dissemination by the transport of infected wood may be important in causing 'sticker stain', when stained, green, cross stickers are used in constructing seasoning piles. It was observed that slabs, edgings, and similar green material are suited to the production of spores in large numbers, thus forming a source of infection, but that old and weathered debris is not. With hardwoods, fruiting of staining fungi is common on the ends of logs and timber cut from stained logs. It is recommended, therefore, that sanitation in and around seasoning yards should include restriction of accumulations of green refuse of both pine and hardwood and wider use of chemical treatments for hardwood log ends.

BADCOCK (E. C.). **New methods for the cultivation of wood-rotting fungi.**—*Trans. Brit. mycol. Soc.*, xxv, 2, pp. 200–205, 2 pl., 1941.

The author describes tests with a new medium for the cultivation of wood-rotting fungi, consisting of sawdust from any species of wood that readily decays, such as beech or spruce, well mixed with 5 per cent. by weight of an 'accelerator' composed of maize meal, bone meal, potato starch, sucrose, and wood ash from the combustion of Scots pine sapwood (50, 30, 17, 2, and 1 parts by weight, respectively). On this, exceptionally vigorous growth was obtained with 20 species of wood-destroying fungi, eight species forming fruit bodies, whereas the growth on sawdust alone always was decidedly inferior and non-fruiting. In tests of the effects of the constituents of the accelerator on the growth of *Merulius lacrymans* both maize and bone meal exerted a pronounced stimulating effect. With timbers containing substances toxic to fungi it is frequently difficult to obtain growth from inoculum on malt agar, but in trials with 25 fungi grown on sawdust plus accelerator inoculated on samples of *Thuja plicata* only five made no growth and some caused bad decay. The medium would therefore appear to be highly suitable for growing organisms to be used in tests on the resistance to decay of naturally durable timbers, or for cultivating the fungi used in the laboratory testing of wood preservatives. The addition of the accelerator to garden soil (20 per cent. by weight) or cotton-wool (sprinkled lightly) also made a suitable medium. By the cotton-wool method inocula can be rapidly prepared for infecting timber in an experimental floor, mine, toxicity chamber, or living tree, the chief advantage being that the inocula can be nailed or tied in almost any position and will probably remain moist long enough for the fungus to grow on to the test material. If necessary, the inocula can be watered.

**Prevention and control of decay in dwellings.**—*Tech. Notes For. Prod. Lab., Wis.*, 251, 4 pp., 1941.

In this note the cardinal principles of good building practice for the avoidance of decay in timber in new buildings are summarized in the form of eight rules, designed to prevent damp. Directions are also given for the repair of buildings already damaged by decay, the first thing to be done being to determine the source of the moisture and remove it.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
OF
# APPLIED MYCOLOGY

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Scott (W. D.). **Pentachlorphenol for wood preservation.**—Abs. in *Timb. Tr. J.*, clvii, 3379, p. 274, 1941.

This is an abridgement of the author's paper intended for presentation at the Zürich Timber Convention, which was abandoned owing to the European situation. Santobrite (sodium pentachlorphenate) is stated to be now widely used in the sawmills of the United States, Canada, and Scandinavia for the control of blue-staining [including *Ceratostomella* spp.] and other fungi [*R.A.M.*, xxi, p. 59]. The chlorinated phenols have also been effectively employed in the protection of exterior mill work against stain and decay. In such cases the treating material must not impair colour and paintability, and a 5 per cent. solution of pentachlorphenate in a colourless petroleum solvent has given satisfactory results, the necessary conditions being fulfilled by Commercial Standard No. 1 Fuel Oil (U.S. Federal Specification). Decay in fence posts has also been successfully combated in the field by pressure treatment with a solution of the above-mentioned type.

Hubert (E. E.). **Preservative treatment of timbers with permatol.**—*Timberman*, xlii, 1, pp. 17, 20, 22, 24, 26, 3 diags., 1940.

Full directions, accompanied by treating schedules, are given for the preservation of timber with permatol [*R.A.M.*, xviii, p. 285], based on the results of laboratory tests with the sap wood and heart wood of ponderosa pine [*Pinus ponderosa*] and white fir [*Abies concolor*]. Eight separate formulae, primarily for the application of the antiseptic to mill work, are given. The cost of the treatment (inclusive of labour) is estimated to range from \$5 to \$14 per 1,000 bd. ft.

Preston (N. C.). **Experiments on the control of club root of Brassicae in gardens and allotments.**—*Ann. appl. Biol.*, xxviii, 4, pp. 351–359, 1 diag., 1941.

Although none of the ten different chemicals tested at the Harper Adams Agricultural College over a period of six years gave complete protection from club root [*Plasmodiophora brassicae*: *R.A.M.*, xx, p. 507] infection, significant practical control of the disease on cabbages and cauliflower was obtained with calomel, a mercury-zinc amalgam, and brassisan, all applied to soil before planting. Mercuric chloride used

in the form of a 1/1500 solution, gave consistently better results than the other materials tested, but the three mentioned are stated to have the practical advantage over it of being relatively non-poisonous and thus especially convenient for use in gardens and allotments. The relative costs of the three mercury treatments (mercuric chloride, calomel, and mercury-zinc amalgam) were approximately in the proportion of 1, 2½, and 6, respectively.

VERONA (O.) & DE MARCHI (I.). **Verträglichkeit von Phoma betae Frank gegen Bor.** [Tolerance of boron in *Phoma betae* Frank.]—*Ann. Fac. agr. Pisa*, N.S., ii, pp. 645–654, 1939. [Abs. in *Chem. Zbl.*, cxii (ii), 24, p. 2989, 1941.]

Minute quantities of boric acid were experimentally shown to exert a stimulatory action on the development of *Phoma betae*, which was retarded or inhibited, on the other hand, by comparatively large amounts of this compound or sodium tetraborate, especially the latter. The fungus was able to grow either in fairly acid or very alkaline media. A case of antagonism between *P. betae* and *Bacillus subtilis* was observed.

LEACH (L. D.). **Seedling diseases of Sugar Beets.**—*Sug. Beet Bull.*, v, 11, pp. 98–99, 1 fig., 1941.

The most uniformly satisfactory control of damping-off of sugar-beet seedlings (*Pythium* [including *P. de Baryanum*], *Rhizoctonia* [*Corticium*] *solani*, and *Phoma* [*betae*], in California is stated to be given by seed treatment with 1 to 1½ lb. ceresan or 6 oz. new improved ceresan per 100 lb. seed. The *Pythium* rot alone will yield to treatment with 2 to 3 lb. red copper oxide per 100 lb. seed, but where either *C. solani* or *Phoma betae* is involved the organic mercury compounds are more effective. The last-named organism was found to be carried in a viable form by 19 out of 35 lots of seed of European origin, whereas 19 home-grown lots were quite free from it. Since most plantings are not made with Pacific Coast seed, little or no importance attaches to *P. betae* as an agent of seedling disease.

In 1938, and again in 1940 and 1941, another seedling disease, resembling damping-off but not amenable to seed treatment, appeared in the moist acid peat or semi-peat soils of the Delta Region, causing widespread havoc in the two last years. The name 'late black root' was suggested by the dark discoloration and shrinkage of the root cortex and hypocotyl, from which an as yet undetermined water mould has been isolated. The pathogenicity of the organism was established by soil inoculation experiments. Control may be effected by steam sterilization of infested soils, while the admixture of lime to bring about an alkaline reaction ($P_H$ 7·4) is also helpful.

YOUNG (H. C.). **Dusting reports in Ohio.**—*Proc. Amer. Soc. Sug. Beet Technol., East U.S. & Can., 1941.* [Abs. in *Sugar*, xxxvi, 12, p. 41, 1941.]

During 1938, when beet blight [? *Cercospora beticola*] was severe in Ohio, spraying and dusting increased yields from 1½ to 3 tons per acre, sugar content from 1 to 1½ per cent., and purity from 1½ to 5 per cent.;

in 1939 the yield increases ranged from 3 to 6 tons per acre. There is considered to be little doubt that the programme is profitable even in seasons of relatively mild infection. In order to reduce the cost of treatment flour may be partially or wholly replaced by bentonite as a dust diluent, the following formula giving the most consistently satisfactory results: 14 lb. copper, $7\frac{1}{2}$ lb. each of wheat or soya flour and bentonite, and 71 lb. talc (No. 23, Eastern Magnesia) [cf. *R.A.M.* xxi, p. 32], but combinations of whiting, gypsum, clays, and other talcs may also be effective. The standard schedule should comprise four applications of 25 to 35 lb. dust per acre.

GLASSCOCK (H. H.). **Varietal susceptibility of Peas to marsh spot.**—*Ann. appl. Biol.*, xxviii, 4, pp. 316–324, 1941.

In varietal resistance trials carried out at Wye, Kent, during 1933 and 1934, the following commercial pea varieties remained free from marsh spot [*R.A.M.*, xix, p. 323]: Captain Cuttle, English Wonder, Fenland Wonder, Gladiator, Superb, Witham Wonder, American Wonder, Pride of the Market, Kelvedon Wonder, and Union Jack. Less marsh spot developed, however, at Wye than on many soils in Romney Marsh and East Anglia, and therefore, though the trials are a guide to relative susceptibility, the results are insufficient to establish the immunity of any given variety. Data obtained by a large firm of seedsmen from an area very prone to marsh spot for the seasons 1926 to 1933 were compared with the results of plot trials at Wye, and it was concluded that the seedsmen's list roughly indicated the reactions of the varieties. The list shows the following as free from marsh spot: Union Jack, Earliest of All, Early White Seedling, First and Best, King of Serpette, Serpette, and William the Conqueror, while Peerless, Prestige, Sutton's V.C., Onward, and Giant Stride were the most susceptible. Late-maturing pea varieties with large seeds seemed to be more severely affected by marsh spot than early-maturing ones with small, round seeds.

PIPER (C. S.). **Marsh spot of Peas: a manganese deficiency disease.**—*J. agric. Sci.*, xxxi, 4, pp. 448–453, 1 pl., 1941.

In a study of marsh spot of peas [see preceding abstract], seedlings were grown in jars in water cultures to which regulated amounts of a solution of manganese sulphate were added. Plants in all series grew normally for the first five weeks, but afterwards those receiving no manganese developed severe mottling of the younger leaves, and brown lesions on the internodes on the stem and near the growing point, all growth ceasing completely within two to three weeks, before the plants reached the flowering stage. In the series receiving 5 and 10 mg. of manganese per l. of nutrient solution, the deficiency symptoms were somewhat delayed and less severe; when all the nutrient solutions in the jars were changed and the amounts of manganese replenished, new vigorous growth was temporarily produced, which again gave room to new severe symptoms and ultimate cessation of growth, only a few flowers, and hardly any pods developing. Plants receiving 20 mg. per l. made apparently normal growth throughout, giving a good yield of ripe seeds, but 33 per cent. of the seeds were severely and 24 per cent.

slightly affected with marsh spot, while 43 per cent. were healthy. Finally, plants receiving 500 mg. per l. grew vigorously, reaching a height of 162 cm., flowering freely, and giving a heavy yield of seeds (13·5 gm. per plant as compared with 10·2, 0·4, and nil in those receiving 20, 10, and 5 mg. or no manganese, respectively), none of which was defective. It is concluded from these data that marsh spot results from a partial deficiency of manganese, soils liable to induce this disease being able to supply small amounts of manganese sufficient to meet the requirements of the plant when it is growing actively, but not sufficient to enable it to build up reserves or to supply the full amount necessary at the time of seed formation.

WEIMER (J. L.). **A leaf spot of Peas (Pisum sp.) caused by Cercospora lathyrina.**—*Phytopathology*, xxxi, 11, pp. 1031–1034, 1 fig., 1941.

Early in September, 1938, and in each succeeding summer, Austrian Winter and other field and hybrid peas (*Pisum arvense* and *P. arvense* × *P. sativum*) growing under a cheese-cloth shelter at the Georgia Agricultural Experiment Station have developed a leaf spot consisting of irregularly scattered, circular to angular, cinnamon brown to mars brown or warm sepia, usually paler-centred, sometimes concentrically zonate lesions (up to 15 per sq. cm.), 1 to 5 or up to 10 mm. in diameter. The young stems, petioles, and tendrils may be similarly affected. The causal organism of the disease, a species of *Cercospora*, was identified by C. Chupp as *Cercospora lathyrina*, a pathogen of perennial sweet peas (*Lathyrus latifolius*), and the results of inoculation tests with the former on both hosts confirmed this conclusion.

WALLACE (G. B.). **Yellow Bean mosaic and notes on other Bean diseases.** —*E. Afr. agric. J.*, vii, 2, pp. 114–115, 1941.

Certain French bean [*Phaseolus vulgaris*] varieties resistant to common mosaic were imported from the United States and sown at Lyamungu, Tanganyika Territory. The resulting plants maintained their resistance to that disease, but became severely affected by a form of yellow mosaic resembling that found in America [bean virus 2: *R.A.M.*, xiii, p. 488; xix, p. 450], where, however, the varieties were only slightly susceptible to this form. It is assumed that the disease was already present in Tanganyika in one or more varieties which acted as carriers. The varieties commonly grown locally, such as Canadian Wonder, Rose Coco, and others, are apparently unaffected. Infection was severe at Lyamungu on Wisconsin Refugee, Idaho Refugee, Red Wisconsin U.1.3 and U.1.34, Great Northern U.1.1, U.1.59, U.1.81, and U.1. 123, and Robust, while Refugee U.S.1 and U.S.5 were only slightly affected. Several Virginian varieties, among others, remained healthy. Not all the characters diagnostic of the American yellow mosaic have been recognized locally but the tendency for the upper surface of some leaves to become concave is fairly constant.

During 1940 beans at Kilimanjaro showed symptoms of sun scorch when half grown. The veins of the leaflets remained green, but the tissue between became yellow and etiolated. Brown areas appeared on the yellow ones, and from a distance the plants looked yellow or brown. The plants prematurely dried up and this resulted in many unfilled pods

and small seeds with their colour undeveloped. Plants sown later were less affected. The high percentage of seeds bearing characteristic orange-coloured blisters suggested that the trouble might be partly bacterial in origin [*Bacterium medicaginis* var. *phaseolicola*: ibid., xix, p. 187].

ZAUMEYER (W. J.) & HARTER (L. L.). **Inheritance of resistance to six physiologic races of Bean rust.**—*J. agric. Res.*, lxiii, 10, pp. 599–622, 7 figs., 1941.

The results of greenhouse experiments in which the resistance of hybrids from four different crosses involving six varieties or strains of beans (*Phaseolus vulgaris*) to races 1, 2, 6, 11, 12, and 17 of bean rust (*Uromyces phaseoli typica*) [*U. appendiculatus*: *R.A.M.*, xx, p. 555] was tested, showed that inheritance to resistance to races 1 and 2 was due to a single Mendelian factor, while other genetic factors may be involved in the resistance to races 6, 11, 12, and 17. The factor for resistance was dominant in hybrids inoculated with races 1, 2, 6, and 12, and incompletely dominant in those inoculated with races 11 and 17. A few of the $F_2$ progenies inoculated with race 6 showed a leaf variegation; those severely variegated were immune, while those mildly variegated were less susceptible than normal plants. It is suggested that this may be due either to a purely physiological reaction of the host and fungus or to modifying genetic factors, or to a combination of these. In the hybrids inoculated with races 11 and 12 a major gene appears to govern resistance within grades 0 to 4 and a similar one the susceptibility within grades 5 to 10. Minor modifying factors may be responsible for the variable degrees of resistance and susceptibility found within the major classes. An $F_2$ progeny closely related to those that were earlier inoculated with race 12 was later inoculated with the same race and exhibited a wide range of types of resistance and susceptibility not previously noted. It is thought likely that these were not recognized before because they were masked by environmental factors and appeared under conditions thus far not exactly determined. Transgressive segregation occurred in the hybrids inoculated with race 11 since a quarter of the $F_2$ plants were more resistant than the less susceptible parent. The $F_3$ progenies of plants giving an intermediate reaction inoculated with race 17 appeared resistant and segregated in a ratio of 3 resistant to 1 susceptible in an unfavourable environment, whereas under more favourable conditions they segregated in a 1 : 2 : 1 ratio, indicating that environment exercised some influence on the degree of infection in the intermediate class.

BOTTOMLEY (A[VERIL] M.). **Onion downy mildew disease.**—*Fmg S. Afr.*, xvi, 188, p. 397, 1941.

Onion downy mildew (*Peronospora destructor*) [*P. schleideniana*: *R.A.M.*, xix, p. 324; xx, p. 442] appeared in almost epidemic proportions in parts of Cape Province and the Transvaal in 1939, though for many years before it had been hardly noticeable in South Africa. Since 1939 infection has occurred locally only in isolated instances. Control is recommended by means of crop rotation, improved sanitary and cultural methods, fungicidal treatments, and the use of resistant varieties (such as certain Californian selections of Italian Red).

Bond (T. E. T.). **Leaf spot diseases of Lettuce and Antirrhinum.**—*Trop. Agriculturist*, xcvii, 2, pp. 62–67, 2 pl., 1941.

Lettuce leaf spot (*Septoria lactucae*) [*R.A.M.*, xx, p. 193] caused considerable damage to young plants in the author's garden in Ceylon in May, 1941, this being apparently the first record of the fungus from the island. Both the Cos and cabbage varieties were affected. Measurements of 50 pycnidia gave diameter 65 to 145 (mean $106{\cdot}9\pm2{\cdot}72$) $\mu$ and ostiole diameter 15 to 40 ($29{\cdot}4\pm0{\cdot}85$) $\mu$. The measurements of 50 freshly exuded spores in water were 29 to 43·5 ($35{\cdot}1\pm0{\cdot}35$) by 1·5 to 3 ($2{\cdot}3\pm0{\cdot}04$) $\mu$.

In April, 1941, a young planting of dwarf *Antirrhinum* [? *majus*] showed leaf spot due to *Phyllosticta antirrhini* [ibid., xx, p. 581], also a new record for Ceylon. Diameters of 20 pycnidia ranged from 90 to 150 (mean $115{\cdot}5\pm3{\cdot}21$) $\mu$, those of the ostioles measuring 20 to 30 ($24{\cdot}8\pm0{\cdot}98$) $\mu$. Measurement of 50 spores in water gave 4 to 6 ($4{\cdot}7\pm0{\cdot}07$) by 1·5 to 2·5 ($1{\cdot}9\pm0{\cdot}04$) $\mu$. The presence of pycnidia on the capsules and on old flower stalks suggests seed infection or infection from parts of these organs present as impurities on the seed. The affected plants were grown from freshly imported seed, none of which was available for examination.

Lambert (E. B.). **Indoor composting for Mushroom culture.**—*Circ. U.S. Dep. Agric.* 609, 15 pp., 3 figs., 1 graph, 1941.

In experiments started at Arlington Farm, Virginia, in 1938 [*R.A.M.*, xx, p. 511], successful mushroom [*Psalliota*] crops were obtained by converting fresh manure into composts by means of fermentation in beds or trays under controlled conditions indoors. Fresh stable manure was chopped in a silage cutter, wetted down to contain about 250 per cent of the dry weight of water, and mixed with 10 to 30 per cent. soil and 2 per cent. superphosphate or 1 per cent. gypsum, all in one operation. It was then immediately taken indoors to prevent souring and placed in beds in the six experimental rooms of 48 plots each, at the rate of 150 lb. per 10 sq. ft. of bed space. The temperature was kept constant by thermostatic control on the optimum level of between 120° and 140° F., regulating the fluctuations within the compost by cooling or warming the surrounding air to remain within a 10° range inside these limits. Water was added to the beds on the third and fifth and again after eight or ten days of composting, thus maintaining a moisture content of about 180 to 200 per cent. Under the experimental conditions the most satisfactory length of composting was 12 days, but when less fresh manure is used, the period might be shortened. At the end of the composting period the manure should be friable, dark brown, speckled with grey fire-fang, free from ammonia odour, and the average $P_H$ should be less than 8·0. Generally, no fungous weeds occurred during composting; all cases of infestation could be traced to deliberate under-composting or overheating. After the compost cooled and the rooms were opened, the usual control measures were observed. The quality of the resulting crop was the same as from beds composted in the conventional manner, and the yield per sq. ft. of bed space averaged from 1½ to 2¼ lb. (or on the basis of raw material, 300 to 400 lb. per ton of fresh manure).

It is suggested that indoor composting has distinct advantages over pure culture tests or outdoor composting as a method for comparing manure supplements and synthetic composts, the tests being best made by holding glass jars of prepared compost at between 125° and 130° for the required number of days, followed by inoculation with spawn and incubation at 70°. Detailed instructions are given for indoor composting by commercial growers, special attention being drawn to the following points. Each ton of manure should be mixed with 20 lb. superphosphate, 20 lb. gypsum, and about 150 lb. soil, wetted freely and broken up. When a short preliminary fermentation has been given the manure should be carried into the house immediately after the final turning and filled at the rate of one ton of wet manure to 150 to 200 sq. ft. of bed space. In order to maintain the temperature inside the beds at between 120° and 135°, the air temperature should be regulated approximately at 90° on the first day, raising it by about 5° on every following day till it reaches 125° to 130° on the eighth day after filling, the application of artificial heat being advisable only during the last few days of composting. The appearance of the composted manure, its $P_H$ value, and the absence of ammonia odour should serve to indicate the termination of the composting period, and after composting, the usual procedure should be adopted for spawning, casing, and disease and pest control.

JENNY (J.). **Stationäre Spritzanlage im Tessin.** [The stationary spraying installation in Ticino.]—*Schweiz. Z. Obst- u. Weinb.*, 1, 24, pp. 477–480, 1941.

Full particulars are given of a communal motor stationary spraying installation, organized and operated by the staff of the Cantonal Agricultural College of Mezzana, Ticino, for spraying vineyards and nurseries against downy mildew [*Plasmopara viticola*: *R.A.M.*, xix, p. 515].

VEITCH (R.). **Report of the Director of Plant Industry (Research).**—Ex *Rep. Dep. Agric. Qd, 1940–1941*, pp. 5–9, 1941.

In this report [cf. *R.A.M.*, xx, p. 151] the author states that conclusive evidence has been obtained that pineapple crook-neck [ibid., xx, p. 152], which has been somewhat severe in certain areas of the Elimbah district of Queensland, can be prevented by very small applications to the soil of zinc sulphate and copper sulphate, though neither is completely effective by itself. A large-scale test at Elimbah showed that the presence of small amounts of zinc and copper in the fertilizer mixture did not enable any reduction to be made in the other fertilizer requirements, while it also demonstrated that, in this locality, the best control resulted when copper sulphate and zinc sulphate were used in the proportion of 2 : 1 by weight.

Promising results are now accruing in the control of pineapple black heart [loc. cit.]. Incidence is associated with disturbance of the normal ripening process, and freedom from the condition has been obtained in experimental work.

A green fruit rot of pineapples associated with a species of *Phytophthora* caused much economic loss in a large plantation in northern Queensland.

When immature bananas were inoculated in the field with *Gloeosporium musarum* [ibid., xix, p. 551], the fungus resumed activity after 5½ months' latency, producing typical anthracnose lesions as the fruit ripened. This discovery accounts for earlier failures to achieve control of anthracnose by surface disinfection during harvesting.

Periodical examination was made of bean [*Phaseolus vulgaris*] crops for seed certification purposes, and a large amount of certified seed is expected to be available.

Sulphur applications to the seed-beds were found useful against chlorosis of hoop pine [*Araucaria cunninghamii*: ibid., xx, p. 152] in nurseries; watering with acidulated water also appeared to effect some improvement.

**Primera Reunión Argentina, de Agronomia, Abril, 1941. Resoluciones y resúmenes de los trabajos presentados.** [First Argentine Congress of Agronomy, April, 1941. Resolutions and summaries of the transactions presented.]—150 pp., B. Aires, 1941.

Included in the section of this report dealing with phytopathology (pp. 81–89) are the following items. None of the wheat varieties actually under cultivation in the Argentine proved to be immune from loose smut (*Ustilago tritici*) in experiments carried out by J. G. Arzuaga and A. D. Montes at the Santa Catalina Phytotechnical Institute in 1939, and the number showing resistance (under 10 per cent. infection) was also relatively small. The necessity of breeding varieties with an improved capacity for withstanding this disease is thus apparent [see below, p. 187].

J. Vallega found none of the varieties of oats tested resistant to all four physiologic races of *Puccinia coronata* occurring in the Argentine, but considerable interest attaches to the selection I.E.I.A. 37·24/629 from the Santa Fe Agricultural Experiment Station, which is resistant to 1, 55, and 56, though susceptible to 45, and further to Bond and its hybrids, resistant to 1 and 56, and to Victoria and its hybrids, resistant to 1 and 45. By means of crossing I.E.I.A. 37·24/629 with Victoria or one of its hybrids, e.g., Klein Mar, resistant to race 45, it is hoped to develop selections of oats resistant to all the races of *P. coronata* existing in the country. Races 55 and 56, isolated for the first time, are both highly pathogenic to Victoria, the former also to Bond but not to Ruakura, and the latter to Ruakura but not to Bond. Race 1, predominating in Canada, the United States, and Mexico, is likewise widespread throughout the cereal-growing region of the Argentine; the other three, though more virulent, are of relatively infrequent occurrence.

From samples of Khapli wheat from Peru, bearing uredosori of *P. graminis*, J. Vallega isolated a new physiologic race of the rust, designated No. 189 and believed to be the most virulent yet discovered and the only one capable of attacking all the differential varieties. Its presence in Peru explains the difficulty of finding resistant varieties in that country, where *P. graminis* is a limiting factor in the coastal districts and Khapli is one of the few sorts adapted to local cultivation.

J. B. Marchionatto found that three physiologic races of *Penicillium viridicatum* (identified by C. Thom) are implicated in the development

of 'mould' in stored maize, which is rendered useless by this defect either for seed or consumption, changes in the chemical composition inducing toxicity to livestock. So common has this trouble become that a maximum of 0·5 to 3 per cent. infection (depending on the climatic conditions of a given season) is allowed by the trade.

*Phytophthora boehmeriae* [*R.A.M.*, xv, p. 58] was determined by C. M. Tucker as the agent of a brown rot of sweet oranges, apparently a new host of the pathogen, investigated by M. J. Frezzi. Inoculation experiments on orange and lemon fruits gave positive results. An intensive study on 'gummy blight' of the branches and gummosis of the trunks of lemons in the Paraná Delta, conducted by H. Speroni, revealed *P. citrophthora* [see below, p. 195] as the causal organism, experiments in the prevention and control of which, covering a period of 3½ years, are stated to have given very encouraging results.

A species of *Phomopsis* was found by Clotilde Jauch to be responsible for a disease of peaches and almonds along the coast characterized by the formation on the twigs of sunken, well-defined lesions, light brown or greyish, 1 to 4 by ½ to 1½ cm. on the former host, ashen-coloured with dark reddish-chestnut borders, ½ to 2½ by ½ to 1 cm. on the latter, and mostly situated near the buds, on the internodes, and at the site of insertion of the branches, which are often killed by the penetration of the mycelium into the cambium. Abundant fructifications of the fungus were produced on steam-sterilized peach and almond twigs. In inoculation experiments the heaviest infection developed on twigs injured aseptically, somewhat less on those wounded by pulling off the leaves, and least on the ones left intact, the percentages thus obtained at a temperature of 17° to 24° C. and a relative humidity of 85 to 95 per cent. being 75, 62, and 23, respectively. The incubation period lasts for 10 to 20 days. Infection spreads most actively in debilitated orchards during periods of heavy rainfall. The shallower and more compact the soil, the more intense is the attack of the pathogen on peaches grafted on free stocks (the common mode in coastal areas); in plantings where Croose and Mussel plums, imported from Holland, served as stocks, the disease did not develop.

The same worker observed *Mycosphaerella pinodes* in epidemic form on peas [ibid., xxi, p. 127] throughout the humid districts of the Argentine, affecting not only the leaves, shoots, pods, roots, and seeds, but even the petals, sepals, and floral peduncles. In potato glucose agar cultures at 9°, 25°, and 31·5°, the rate of development of *M. pinodes* was compared with that of two other common parasites of the same host, *A*[*scochyta*] *pinodella* and *A. pisi*, and found to assume an intermediate position, *A. pinodella* making the most rapid growth and *A. pisi* the slowest. The results of seed treatment tests indicated that the most promising preparations are dusts with a mercury base, e.g. mercurisan and abavit, followed by such copper-containing products as ibis and copper carbonate. Spraying with 1 per cent. Bordeaux mixture plus an adhesive increases the yield and improves the condition of the seed, but, owing to the repeated number of applications necessary, this method of control is uneconomic. Fortnightly sowings were made in 1940 at a quarantine station to determine the effect of the planting date on the incidence of *M. pinodes* on six varieties. The best yields

were obtained from sowings made between 1st June and 15th September, those of earlier dates being severely attacked by the fungus and the later ones in general developing very poorly.

Elisa Hirschhorn's studies on *Urocystis* at the Spegazzini Institute of Botany, La Plata, have led to the transference of *U. americana* (Speg.) De Toni to *U. occulta* (Wallr.) Rabenh. and of *U. andina* (Speg.) Cif. to *U. anemones* (Pers.) Wint. [ibid., xvii, p. 181]. The proposed substitution of *Tuburcinia* for *Urocystis* is not approved [ibid., xx, p. 598].

Elrod (R. P.). **Serological studies of the Erwineae. I. Erwinia amylovora.**—*Bot. Gaz.*, ciii, 1, pp. 123–131, 1941.

An abstract of this paper has already been noticed from another source [*R.A.M.*, xx, p. 212].

Link (G. K. K.) & Eggers (Virginia). **Hyperauxiny in crown gall of Tomato.**—*Bot. Gaz.*, ciii, 1, pp. 87–106, 1 fig., 1941.

A detailed account is given of a study on the extraction of auxins from non-inoculated hypocotyls of tomato and from hypocotyls of comparable plants bearing crown galls produced by inoculation with *Phytomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xix, pp. 202, 560].

Preliminary experiments indicated that frozen vacuum dried tomato material does not yield auxins to dry ether, the free auxin being apparently fixed until free water liberates it. Wet ether gave the best results as an extractant, but even after 17 successive extractions lasting 209 days, the process of auxin liberation was not completed. Material boiled before extraction yielded all its free auxin in one extraction by soxhletization with wet ether for 24 hours.

Comparative assays of the auxin content of uninoculated and inoculated hypocotyls 20, 22, 26, and 29 days after inoculation showed that for each pair the gall extracts gave a conspicuously higher assay than the extracts of the uninoculated hypocotyl, the ratios of difference ranging from 1: 5·4 to 1 : 15 for the various dates.

Inoculated and uninoculated samples were next subjected to 17 successive extractions with wet ether during a period of 209 days. On every occasion the gall-bearing hypocotyl gave a higher auxin assay than the healthy hypocotyl. The amount of difference varied, and was greatest after the third extraction. The total units of auxinic activity of the extracts from the uninoculated and inoculated hypocotyls were 379 and 1,866, respectively.

In short extractions with wet ether the uninoculated material gave yields of 0, 0, and 10 units in 5, 20, and 60 minutes, respectively, while the inoculated gave 98, 132, and 145 units, respectively. With water as extractant (24 hours at 2°) the uninoculated and inoculated hypocotyls yielded 38 and 188 units, respectively. Neither the uninoculated nor the inoculated hypocotyls yielded any active extract by soxhletization. With continuous ether extraction the uninoculated material gave no measurable amount, and the inoculated 90 units.

A preliminary test showed that tomato auxin was not destroyed by boiling in water but that boiling destroyed either the agent by which, or the substance from which, potential auxin is liberated or both.

Further experimental evidence indicated that boiling destroyed the enzyme which liberated auxin rather than the precursor, and that a proteolytic enzyme can liberate auxins from the cell constituents of higher plants. The data obtained indicate that the gall at any moment contains a relatively large amount of free auxin which is liberated rapidly in extraction, but that auxin formation from its precursor proceeds slowly and at a decreasing rate.

From these studies it is concluded that extracts of the gall-bearing hypocotyls give higher free and potential auxin assays than extracts of healthy hypocotyls. This holds for all pairs of samples tested and for all extractants and methods of extraction used.

Dillon Weston (W. A. R.). **Prevention of disease in corn crops.**—*J. Minist. Agric.*, xlviii, 3, pp. 176–180, 1941.

Brief, practical notes are given on the disinfection of wheat, oats, and barley seed-grain by means of organic mercurial dusts [cf. *R.A.M.*, xx, p. 9].

Giordano (H. J.). **El Trigo Sinvalocho M.A. (Sin Rival × 38 M.A.—No. 32 Rafaela).** [The Wheat Sinvalocho M.A. (Sin Rival × 38 M.A.—No. 32 Rafaela).]—*'Granos' Semilla Selecta, B. Aires*, iii, 10, pp. 3–16, 2 pl., 1939. [Received 1941.]

A full account is given of the characteristics of the Sinvalocho M.A. wheat variety, a hybrid between Sin Rival and 38 M.A. from the Rafaela Experiment Station, including its reactions to the principal diseases affecting the crop in the northern cereal-growing districts of the Argentine, viz., brown, black, and yellow rusts (*Puccinia triticina*, *P. graminis*, and *P. glumarum*) [*R.A.M.*, xx, p. 9; xxi, p. 133] and loose smut (*Ustilago tritici*). The hybrid is equal or superior to 38 M.A. in resistance to *P. graminis* and *P. triticina*, its very early maturity (6 to 10 days before 38 M.A.) assisting in its escape from the former. It has further inherited from 38 M.A. immunity from *U. tritici*, but is somewhat susceptible to *P. glumarum*.

Klein (E.). **Tres nuevas variedades culturales de Trigo.** [Three new cultivated Wheat varieties.]—*Rev. argent. Agron.*, viii, 2, pp. 154–160, 1941.

Particulars are given of the characteristics of three wheat varieties newly developed by the writer at the Plá (Buenos Aires) Plant Breeding Station, viz., Klein 157, Klein Exito, and Klein Alberti, all of which are resistant to the black, brown, and yellow rusts (*Puccinia graminis*, *P. triticina*, and *P. glumarum*) and loose smut [*Ustilago tritici*: see preceding abstract], and the first-named also to *Septoria tritici* and *S. nodorum*.

Vallega (J.). **Especialización fisiológica de Puccinia graminis tritici en la Argentina, Chile y Uruguay.** [Physiologic specialization of *Puccinia graminis tritici* in the Argentine, Chile, and Uruguay.]—*Rev. argent. Agron.*, vii, 3, pp. 196–220, 1940. [English summary.]

Seven physiologic races of *Puccinia graminis tritici* were identified at University Farm, St. Paul, Minnesota, by Stakman and Levine's

method [*R.A.M.*, ii, p. 158] from collections made in the Argentine [see preceding abstracts], Chile, and Uruguay, viz., 11, 14, 15, 17, 21, 36, and 42, of which 17 and 42 were the most prevalent and widespread in the Argentine and 17 in Uruguay, while in Chile 15 was generally distributed and 14, 17, and 11 predominated in the north, central regions, and south, respectively. Races 11 and 15 also occurred in the Argentine and 42, 36, and 21 in Uruguay. All the races except 36 were found to be highly pathogenic to durum wheats, and all except 21 attacked einkorn (*Triticum monococcum*); the Vernal and Khapli varieties proved susceptible only to 15 and 42. The last-named race has previously been reported from Egypt, India, and possibly occurs also in Abyssinia [ibid., xvii, p. 732], but not in North America, where all the others listed are present. Particular interest attaches to race 42 on account of its capacity for the infection of Khapli under strong illumination; although this variety has hitherto been resistant in the field, adult plants are susceptible in the greenhouse and may well react similarly in the open given favourable conditions.

The relationship of barberries to the origin and perpetuation of black rust of wheat in Argentina has not been fully investigated, neither is it known whether viable spores are blown from North to South America and vice versa.

The results of inoculation experiments with the physiologic races under discussion on 160 wheat varieties showed that the great majority of those grown in the Argentine and Chile are susceptible to all seven, the following constituting partial exceptions: Kanred is resistant to 17, 42, 21, and 14; Barrukan resistant to 17 and 14 and moderately so to 11; Guatraché and Utrakan resistant to 14 and 21; Bonaerense and Húngaro moderately resistant to 15; and Mentana slightly susceptible to 15 and highly resistant to 42. Among the foreign varieties, Kowar, Pilot, Rival, and Vesta showed resistance to races 11, 14, 17, and 42, Mercury and Merit to 11, 14, 36, and 42; Webster was moderately susceptible to all seven, and two Kenya hybrids were resistant to 11, 14, and 17. A high degree of resistance to the predominant Argentinian races, 42, 17, and 11, was further exhibited by several hybrids of Heines Kolben [Club]×38 M.A. developed at the Santa Catalina Phytotechnical Institute.

FAHMI (T.). **A technical method of selecting Wheat resisting black rust (Puccinia graminis).**—*Egypt. agric. Rev.*, xix, pp. 184–192, 1941. [Arabic. Abs. in *Plant Breed. Abstr.*, xii, 1, p. 42, 1942.]

Uredospores of *Puccinia graminis* are collected and maintained in an active state by the injection of spore suspensions into susceptible varieties, which are sown once a week, inoculated just before flowering, and kept under conditions favouring the spread of the rust. Before the normal date of sowing, seed of susceptible varieties is sown in rows, and the resultant plants inoculated with the activated spores in such a way as to insure the rapid and uniform spread of infection, the dead plants being replaced by new ones, which are immediately inoculated, to preserve a high degree of virulence in the field. At the normal time of sowing, single plants of the stock under selection are interplanted among the contaminated rows. The progress of the disease is recorded

weekly, and individual plants combining resistance with other desirable characters are selected and bred for several generations under the same conditions until the requisite qualities become fixed. This method is only adapted for use under conditions conducive to the early dissemination of *P. graminis*.

HUMPHREY (H. B.). **Climate and plant diseases.**—*Yearb. Agric. U.S. Dep. Agric., 1941*, pp. 499–502, 1941.

In this paper the author briefly discusses the influence of weather conditions in inducing epidemics of plant diseases. He points out that in 1915 the spring wheat crop in the United States reached a total of 368,000,000 bush., with an average yield of 17·8 bush. per acre, but in 1916 the corresponding figures dropped to 178,000,000 and 9·2 bush. per acre, the difference of nearly 200,000,000 bush. being due mainly to a rust [*Puccinia graminis*] epidemic, made possible by one month's warm, moist weather in July, 1916. While weather conditions remain unalterable, the amount of inoculum present and the acreage of susceptible hosts can be reduced by growing resistant varieties, thus offsetting the effects of climate. A new rust-resistant wheat developed in Texas by co-operative research is expected shortly to be distributed, to eliminate overwintering infections in southern areas. This will not only protect the Texas wheat crop, but will cut off inoculum from susceptible varieties grown to the north and east [*R.A.M.*, xviii, p. 239 *et passim*].

PLATT (A. W.), DARROCH (J. G.), & KEMP (H. J.). **The inheritance of solid stem and certain other characters in crosses between varieties of Triticum vulgare.**—*Sci. Agric.*, xxii, 4, pp. 216–224, 1 graph, 1941.

The inheritance of stem solidness, stem rust (*Puccinia graminis tritici*) reaction, awning, and glume colour was studied in segregating generations of crosses involving Renown and Thatcher as hollow-stemmed, stem rust-resistant, awnletted, white-chaffed parents, and S–615–9 and S–615–11 as solid-stemmed, stem rust-susceptible, awned, brown-chaffed, and S–633–3 and S–633–23 as solid-stemmed, stem rust-susceptible, awnletted, white-chaffed parents.

The evidence suggested that stem rust reaction was governed by a dominant factor for resistance and an inhibitor in the crosses Thatcher and S–615–11, Renown×S–615–9, and Renown×S–633–3. Several factors appeared to participate in the cross Thatcher×S–633–23, only one resistant $F_3$ line in 467 being found. Stem rust reaction and glume colour were not associated with stem solidness.

JOHNSON (T.) & NEWTON (MARGARET). **The predominance of race 56 in relation to the stem-rust resistance of Ceres Wheat.**—*Sci. Agric.*, xxii, 3, pp. 152–156, 1941.

Observations and experiments made to ascertain whether Ceres wheat in Canada was more resistant to stem rust (*Puccinia graminis tritici*) before 1935, when race 56 became predominant in the Great Plains regions, than it has been since [*R.A.M.*, xvii, p. 381], and whether it is less resistant to this race than to others, which were previously more prevalent, showed that race 56 is in fact more pathogenic to this

variety than races 21, 34, 36, 38, and 49, which were the chief components of stem rust epidemics in western Canada when Ceres wheat was seldom seriously attacked. Little doubt can be entertained that the predominance of race 56 since 1935 is a factor responsible for the more severe rust observed on Ceres in recent years. The disappearance of this variety as an economically important wheat was not solely due to the predominance of race 56 but also to the production of wheat varieties possessing greater resistance than Ceres. But the case illustrates the impairment of the productive value of a widely grown wheat variety by the ascendancy of a new physiologic race of stem rust and the possibility of similar occurrences must be faced in the future.

Demyanovitch (N. I.). Итоги работы Льговской опытноселекционной станции по выведению устойчивых сортов озимой Пшеницы. [The results of work at the Ljgoff Experimental Selection Station on breeding resistant varieties of winter Wheat.]—*Научн. Зап. по Сахарн. Пром.* [*Sci. Notes Sug. Ind.*], *Kieff*, [Grey Ser.], xvi, 2–3, pp. 92–100, 1939.

In varietal trials of the resistance of winter wheats to brown rust (*Puccinia triticina*) [*R.A.M.*, xx, p. 455] and bunt (*Tilletia tritici*) [*T. caries*: ibid., xviii, p. 447] conducted from 1934 to 1937 at the Ljgoff experimental Selection Station [Central U.S.S.R., Kursk district], the following varieties showed the greatest promise: Bear 11×21/64 was resistant to *P. triticina* (showing from 0·0 to 21·5 per cent. infection) and a good yielder, but was susceptible to *T. caries* (8·6 to 53·1 per cent. infection); Zarya×599 combined resistance to brown rust with resistance to bunt; the crosses 1188×074, 407×237, 246×348 gave high yields, were hardy and resistant to rust and some lines among the progenies of the two first crosses were also resistant to bunt; and the cross 332×294 was highly resistant to bunt in all stages of the selection process. Of the latest crosses the following are held to be the most promising: (Bear 11×21/64)×599; (332×294)×6–86; (332×294)×074; and also some crosses between the best varieties of this station with those of others.

Holton (C. S.) & Heald (F. D.). **Bunt or stinking smut of Wheat (a world problem).**—ii+211 pp., 20 figs., 1 graph, Minneapolis, Minn., Burgess Publishing Co., 1941. $3·25 (payable in U.S. Funds) post free.

The writers' object in the compilation of this treatise was to present in a single publication the principal available information on various aspects of the wheat bunt (*Tilletia tritici* and *T. levis*, or strictly according to the International Rules of Botanical Nomenclature, *T. caries* and *T. foetida*) problem. The work is divided into eleven chapters, each followed by a bibliography of the relevant literature, namely, (I) introduction; (II) economic importance of bunt; (III) species distinction, spore germination, and artificial culturing of the bunt fungi; (IV) host range of the bunt fungi and other species of *Tilletia* affecting wheat or other cereals; (V) factors affecting infection by the bunt fungi and their development in the host; (VI) effect of bunt on the morphology and physiology of the wheat plant; (VII) physiologic specializa-

tion in the bunt fungi; (VIII) cytology of the bunt fungi; (IX) heterothallism, hybridization, and species association in *T. caries* and *T. foetida*; (X) varietal reaction and the genetics of resistance to bunt; (XI) seed treatment and cultural practices for bunt control. Many of the more recent papers cited have been noticed from time to time in this *Review*.

SABOUROVA (Mme P. V.). **Physiologische Besonderheiten bei der Bildung der an Ustilago tritici erkrankten Weizenähre.** [Physiological peculiarities in the development of Wheat ears infected with *Ustilago tritici*.]—*C. R. Acad. Sci. U.R.S.S.*, N.S., xxviii, 3, pp. 270–273, 1940.

In a study with vernalized wheat of the varieties Albosar and Albidum artificially infected with *Ustilago tritici* [*R.A.M.*, xix, p. 398] it was found that suction pressure ['Saugkraft'] in a diseased ear did not differ from that in a healthy one till the third and fourth nodes were formed, when it was, respectively, 1·90 and 4·36 atmospheres lower in the variety Albosar, and 0 and 4·89 in Albidum. Since all other conditioning factors were the same in both ears, the difference in suction pressure is explained on the basis of a possibly lower concentration of osmotically active substances in diseased ears. This is probably connected with the nutritional exhaustion of the plant caused by the fungus. The osmotic pressure was found to be slightly higher in healthy ears than in diseased ones. Thus, in the third-node phase the osmotic pressure in healthy Albosar and Albidum ears was 10·06 and 9·76 atmospheres, respectively, as compared with 8·79 and 8·53 in diseased ears; in the fourth-node phase the corresponding figures were 11·32 and 10·98 as compared with 7·55 and 7·32, respectively. It was observed that at concentrations at which the cells of the host plant were already showing plasmolysis, the mycelium of the fungus within these cells showed none and it is concluded that the osmotic concentration is higher in the mycelium than in the cells of the host plant. The water content of diseased ears in both wheat varieties was lower than that of healthy ones (namely, 629·64 and 579·86 per cent. of the dry weight, respectively, in healthy Albosar and Albidum, both fifth-node stage, as compared with 449·81 and 325·30 in the diseased). There appeared to be no noticeable difference in the $P_H$ values of the diseased or healthy ears or the mycelium of the fungus.

GORLENKO (M. V.). **Neue Befunde über die Biologie von Erysiphe graminis tritici March.** [New results concerning the biology of *Erysiphe graminis tritici* March.]—*C. R. Acad. Sci. U.R.S.S.*, N.S., xxvii, 8, pp. 866–870, 3 figs., 1940.

Field observations and studies initiated in 1938 at the Voronezh Plant Protection Station showed that *Erysiphe graminis tritici* overwinters on the lower leaves of winter wheat in the form of dense, brown mycelial mats. In the following spring conidia develop on these mats, and new, smaller and often almost white pustules soon appear, first in the proximity of the old mats, then on the adjoining leaves of the same plant, later to spread to neighbouring plants. The possibility of summer infection through perithecia overwintering on the remains of last year's

harvest was investigated, but counts showed that whereas only 1 to 2 per cent. of diseased plants developed in the vicinity of such remains, 23 to 28 per cent. developed next to stands of winter wheat. It is concluded, therefore, that stubble and crop debris do not constitute an important source of infection in summer wheat. The life-cycle of the fungus in the Voronezh district appears to run through the following stages: (1) maturation of the ascospores (August, September, and October); (2) infection of winter wheat through the ascospores (September and October) followed by the overwintering of the fungus on winter wheat in form of mycelial mats; (3) the development of the disease on winter wheat (April and May); (4) spread of the disease to summer wheat; (5) the formation of perithecia on the winter and the summer wheats (second half of May and first half of June, respectively); (6) further development of the fungus on summer wheat; and (7) the dormancy of the ascigerous stage on harvest remains (late July, August, September). It thus appears that, contrary to previous assumptions, the hardy ascigerous stage does not constitute an important mode of overwintering for the fungus [cf. *R.A.M.*, xvii, p. 306] but provides a means for ensuring the infection of winter wheat in the late autumn.

Fellows (H.). **Effect of certain environmental conditions on the prevalence of Ophiobolus graminis in the soil.**—*J. agric. Res.*, lxiii, 12, pp. 715–726, 3 graphs, 1941.

In studies at the Kansas Agricultural Experiment Station *Ophiobolus graminis* grown in pure culture on potato dextrose agar and exposed to the winter cold of 1925–6 and 1926–7 remained viable, surviving a temperature as low as —2° F. When cultures of the fungus were subjected to repeated alternations of temperature ranging from 70° to —20°, viability was also unaffected. The micro- and macro-hyphae were killed by exposure to 122° (50° C.) for 10 minutes, but the fungus remained viable after 10, 20, and 30 minutes' exposure to a temperature of 113° F. (45° C.).

In naturally infected soil [*R.A.M.*, xviii, p. 585] the fungus survived a temperature of 160° F. (71° C.). In experiments on the effect of summer heat and drought on the fungus in soil the relative abundance of the fungus in the upper soil layers was compared with that in the deeper layers less subject to heat and drought. It was found that high temperatures and drought in summer only slightly reduced the infestation in infested soils. In another experiment the abundance of the fungus in infected soils was not reduced by repeated alternations from growing to sub-freezing temperature.

Different combinations of moisture, temperature, and compactness of the soil during storage reduced infestation to a varying extent, but viability persisted in either moist or dry infested soil kept in a warm greenhouse for 777 days. Under the condition of the experiments the storage temperature of the infested soil had more effect on the viability of *O. graminis* than any other factor, a cool temperature favouring the fungus regardless of other factors. Both moisture and compactness modified the effect of temperature on the prevalence of the fungus; when the soil was cool and loose, moisture was of little importance but the addition of moisture to warm soil, and especially a loose one, tended

to rid the soil of the fungus. Infestation did not increase under any conditions of storage but was reduced most in a warm, loose, moist soil, and least in a cool, compact, moist one.

MacLachlan (J. D.). **Manganese deficiency in soils and crops. I. Control in Oats by spraying; studies of the role of soil micro-organisms.**—*Sci. Agric.*, xxii, 3, pp. 201–207, 2 pl., 1941.

Oats sown in a field in Ontario, in a well-defined area of which oats and barley failed to reach normal maturity, developed chlorotic symptoms and stunting within about a month. Plots within the affected area were sprayed with ¼, ½, 1, and 2 per cent. solutions of borax, zinc sulphate, iron sulphate, and manganese sulphate, and within ten days all plots sprayed with the last-named had resumed the normal colour, whereas the other applications induced no response. Comparative tests showed that a single spray application of 1 per cent. manganese sulphate four to eight weeks after sowing was more effective than soil applications of 140 or 280 lb. per acre applied to the sowing drill, the former yielding a grain weight (expressed as a percentage of the above-ground parts) of from 19·6 to 23·2 (23·6 when bentonite and soap were added to the spray) and the latter only 12·2 and 19·1, respectively.

The possibility that soil bacteria were a factor in the manganese deficiency was investigated, utilizing the technique of Gerretsen [*R.A.M.*, xv, p. 356].

Bacteria isolated from the soil of the affected areas in question actively converted manganese sulphate to the oxide form *in vitro*, and it would appear that this soil contains an excess of bacteria which contribute to manganese oxidation, reducing the level of available manganese below the minimum requirements for the normal development of oats. Bacteria capable of oxidizing manganese were also isolated from the adjacent soil carrying a normal oat crop but they were fewer in number and insufficient to upset the balance of the microflora whereby sufficient manganese is available for normal development.

Sherman (G. D.) & Harmer (P. M.). **Manganese deficiency of Oats on alkaline organic soils.**—*J. Amer. Soc. Agron.*, xxxiii, 12, pp. 1080–1092, 5 figs., 1941.

Wolverine, Iogold, and Gopher oats, grown in the greenhouse at the Michigan Agricultural Experiment Station on alkaline organic soil ($P_H$ 7·4 to 7·8) and receiving weekly applications of sodium nitrate in addition to a 0–8–24 mineral fertilizer at the rate of 500 lb. per acre, developed severe symptoms of grey speck, the Huron variety sustaining relatively slight damage under identical conditions. Further studies were conducted mainly on the first-named highly susceptible variety, on which the following stages in the breakdown were recognized. A faintly greyish lesion develops, generally about half-way along the leaf, gradually becoming more pronounced until, after a few days, the upper part of the leaf breaks over at a sharp angle. The greyish tint gives way to a round or oval, bright yellow colour, with a reddish fringe encircling the periphery of the lesion and imparting a halo effect, the grey shade in the meantime extending outwards into fresh tissue. The death of all

the basal tissue is followed, but not for some time, by that of the leaf tip. Hot, dry weather, however, may stimulate the formation of new leaves and a certain amount of seed production. A cool season favours the grey speck stage of the disease, while at higher temperatures the halo phase predominates. Grey speck (of which this is the first record in the United States) has also been observed on occasional high-lime mineral soils in the State.

The most practical method of combating the disease on an alkaline organic soil consists in the application of manganese sulphate [*R.A.M.*, xx, p. 459 and cf. preceding abstract] at the rate of 100 to 400 lb. per acre or of sulphur in amounts sufficient to reduce the $P_H$ value to a point somewhat below $P_H$ 7·0. Experimentally, grey speck was found to be controllable by the incorporation with the soil of any manganous salt or permanganate, sulphur, sulphuric acid, hydroquinone, creatinin, haemoglobin, or stannous chloride. The data obtained in these tests strongly indicate that any treatment increasing the exchangeable manganese in the soil to upwards of 3 p.p.m. will prevent the development of grey speck, a process that can be accomplished either by the addition of soluble manganese or by the reduction of manganic to manganous manganese by chemical means.

KERNKAMP (M. F.) & MARTIN (W. J.). **The pathogenicity of paired haploid lines of Ustilago zeae versus the pathogenicity of numerous mixed haploids.**—*Phytopathology*, xxxi, 11, pp. 1051–1053, 1941.

In comparative inoculation experiments on Northwestern Dent maize seedlings at the Minnesota Agricultural Experiment Station with single pairs of haploid lines of *Ustilago zeae* and bulk inoculum comprising all the haploid lines used in the single pairs, the virulence of the former ranged from 0 fleck to 4+, while that of the latter was computed at 2—. All inoculations were made by injecting potato-dextrose broth suspensions of the haploid lines into the plants. In another test, in which measured quantities of inoculum were used in the single pairs and the composite inoculum contained equal proportions of each haploid line, two series of inoculations were made, one consisting of four single highly virulent pairs and the composite of these four combinations, and the other of four pairs ranging from relatively low to high virulence and the composite of those lines. The virulence of the composite inoculum in each series approached that of the single pairs in each series. Similarly, the reaction of the composite of all the lines in both series was intermediate between the reactions of the composites of both series. These results are taken to indicate that the dilution of lines in bulk inoculum is not the explanation of the relatively low degree of virulence of such infective material. Further experiments showed that the presence of a weakly pathogenic pair inoculated into maize seedlings did not prevent the development of a highly virulent pair in subsequent inoculations, though inoculations in the reverse order gave erratic results. No evidence was obtained that one pathogenic strain might exert an antibiotic effect on another. The authors conclude from these studies that care is necessary in the classification of resistant varieties on the basis of their reaction to bulk inoculum.

Frezzi (M. J.). **La 'Phytophthora citrophthora', causante de la podredumbre del pie del Naranjo y la gomosis del tronco del Limonero, en Corrientes.** [*Phytophthora citrophthora*, causing foot rot of Orange and trunk gummosis of Lemon in Corrientes.]—*Rev. argent. Agron.*, vii, 3, pp. 165–171, 4 pl., 2 figs., 1940.

*Phytophthora citrophthora* has in general been found to be much less widespread on citrus in the Argentine than *P. parasitica* [*R.A.M.*, viii, p. 238; xx, p. 401], the latter having been isolated from over 70 cases of foot rot of sweet and sour oranges, Persian and Rangpur limes, Eureka and Genoa lemons, and tangerines, whereas the former was associated (in the main series of experiments) with only one sweet orange suffering from foot rot and one lemon affected by gummosis of the trunk (brown rot). As the paper was going to press, however, *P. citrophthora* was further isolated from one-year-old lemons grafted on sour orange stocks and showing symptoms of gummosis and necrosis at the site of insertion, as well as from sweet orange, pomelo, and lemon fruits with brown rot.

The cultural and morphological characters of *P. citrophthora* are described. Inoculation experiments with pure cultures on 1 per cent. glucose agar, introduced through cortical incisions, resulted in the formation on lemons, and to a lesser extent on oranges (10- to 15-year-old trees), of actively growing cankers exuding an abundance of honey- to amber-coloured gum.

Periodical applications to the trunk and main branches of Bordeaux paste or whitewash should prevent the onset of infection by *P. citrophthora*, while curative measures should comprise abrasion of the cankers, disinfection with 1 in 1,000 mercuric chloride, and treatment of the wounds with Bordeaux paste, tar, or a similar protective substance.

Bliss (D. E.). **Relation of Ceratostomella radicicola to rhizosis of the Date Palm.**—*Phytopathology*, xxxi, 12, pp. 1123–1129, 5 figs., 1941.

*Ceratostomella radicicola* having been found associated with date palm rhizosis [*R.A.M.*, xxi, p. 13] in less than half the cases investigated at the Citrus Experiment Station, California, some doubt arises as to whether this fungus is the sole factor involved in the etiology of the disease, more especially as many mature palms die suddenly with all the symptoms of rhizosis except the presence of the organism in the roots. Inoculations into wounded seedling Deglet Noor date palms with *C. radicicola*, however, caused rapid necrosis, the leaf bases, in the cells of which macrospores of the *Chalaropsis* stage of the fungus were formed, and primary roots being blackened and decayed and the mycelium and spores detected, not only in these organs, but also in the trunk and terminal bud. The fungus also proved highly pathogenic to uninjured green fruits of the same variety, which began to fall from the strands and undergo rapid decomposition on the fourth day after inoculation.

Other fungi associated with rhizosis included *Trichoderma lignorum* [*T. viride*], *Fusarium* sp., and *Rhizoctonia* [*Corticium*] *solani*.

FICKENDEY (E.). **Kali- und Magnesiamangel in gewissen Böden von Sumatra.** [Potash and magnesia deficiency in certain soils of Sumatra.]—*Ernähr. Pfl.*, xxxvii, 11–12, pp. 88–89, 1941.

Oil palms growing in the sandy loam soils of the alluvial plain between the Asahan and Barumum rivers on the east coast of Sumatra, with a hard layer at a depth of 0·75 to 1 m. which obstructs the downward movement of the roots, exhibit the following pathological symptoms. The pinnate leaves develop yellow spots and stripes, which expand and ultimately become confluent; instead of the taut extension of the normal foliage, the two halves of the affected leaves slope towards one another, indicating an attempt on the part of the palm to reduce transpiration, the brown to black, necrotic roots being unable to maintain the necessary supply of water. The affected leaves shrivel and die prematurely. The application to the soil of factory ash resulted in a complete cure, and similarly beneficial effects were exerted by potassium carbonate, potassium sulphate, and patent potash, especially the first-named. Potassium chloride alone was injurious to the palms but improved their condition when mixed with calcined shell lime. The leaf ash of diseased palms in a neighbouring plantation having revealed a remarkably low content of magnesia as well as of potash, potassium sulphate and calcined dolomite were applied to the soil in large-scale tests with satisfactory results.

MILLER (P. R.) & WEINDLING (R.). **A survey of Cotton boll rot diseases and associated microorganisms in 1941.**—*Plant Dis. Reptr*, xxv, 20, pp. 518–521, 1 map, 1941. [Mimeographed.]

As in the three preceding years of the cotton boll disease survey [*R.A.M.*, xxi, p. 14], *Glomerella gossypii* was again the predominant pathogen on material collected east of Texas and Oklahoma. On the other hand, the water-soaked spots commonly attributed to *Phytomonas* [*Xanthomonas*] *malvacearum* were less prevalent than heretofore, and the percentage of such lesions yielding the causal organism was much lower than in 1940, namely 13 as compared with 41 per cent. Tables are given showing the frequency of occurrence of micro-organisms in sample lots of bolls and in cultures from individual bolls, expressed in terms of percentage in both cases.

CHESTER (K. S.). **The probability law in Cotton seedling disease.**—*Phytopathology*, xxxi, 12, pp. 1078–1088, 4 graphs, 1941.

At the Oklahoma Agricultural Experiment Station a mathematical analysis was made of the survival of cotton seedlings in the greenhouse and field under varying conditions of infection by *Glomerella gossypii*, *Fusarium moniliforme* [*Gibberella fujikuroi*], *Rhizoctonia* [*Corticium*] *solani*, and other seed-infesting fungi [see preceding abstract], with a view to determining the extent to which an infected plant is hazardous to those in the immediate vicinity.

Given freedom from severe infection by *C. solani*, the mortality of seedlings from diseased seed followed a random distribution, agreeing with the formula derived by expansion of the binomial equation. The absence of a skew distribution, with an excessive number of seedling failures in hills containing one or more infected seeds, is taken to

indicate that, *C. solani* being excluded, diseased seedlings do not ordinarily constitute a threat to the health of adjoining sound ones. This hypothesis was confirmed by direct observation of the success of healthy seedlings in the presence of diseased ones in soil free from *C. solani*, as well as by the equal emergence rates of seedlings from mixtures of infected and sound seed whether planted under conditions of many or few potential contacts between diseased and healthy seedlings. On the other hand, where *C. solani* was a factor, an unduly high proportion of seedling failures, attributable exclusively to this cause, was registered in hills originally containing one or more diseased seedlings. These data explain the greater utility of ceresan seed treatment in the south-eastern States, where *G. fujikuroi* and *Glomerella gossypii* are the principal agents of seedling disease, as compared with those of the south-west (Texas and Oklahoma), in which acid delinting is more successful against the predominant pathogen, *C. solani*, by curtailing the period of susceptibility of the host. In this connexion the writer emphasizes the urgent need for further development of chemical protection of cotton and legume seed against *C. solani* in the south-west, volatilization over a relatively long period being the foremost requirement in a fungicide intended for such a purpose. The observation that the infection of a given seedling does not endanger the health of those surrounding it has a bearing on the planting value of partially infested seed, which may be regarded, other factors being equal, as proportional to the results of laboratory germination tests.

Smith (A. L.). **The reaction of Cotton varieties to Fusarium wilt and root-knot nematode.**—*Phytopathology*, xxxi, 12, pp. 1099–1107, 2 figs., 1 graph, 1941.

Observations in the Coastal Plain area of Georgia in 1940 indicated an association between resistance to the root-knot nematode (*Heterodera marioni*) infestation and freedom from wilt (*Fusarium vasinfectum*) [*R.A.M.*, xix, p. 146], but the relationship appears to be casual, since some wilt-resistant varieties, e.g., Delfos 425, Dixie Triumph 06–366, and Sea Island Seabrook 31–12 B–2, show no more resistance to root knot than the wilt-susceptible and semi-resistant varieties. Resistance to *H. marioni* was confined to wilt-resistant varieties originating in the lighter types of local Coastal Plain soil in South Carolina, such as Early Wilt, Coker's 4 in 1 strain 4, and Wannamaker Cleveland, whereas the wilt-resistant types developed on the heavier soils of Mississippi and Louisiana, where root knot is a less acute problem, were all susceptible to the nematode. Plant-breeders and pathologists would be well advised to devote some attention to the selection of strains combining resistance to the nematode and fungus. In this connexion the writer describes a system for the numerical evaluation of nematode infestation in cotton plants, whereby an increasing incidence of root knot can be represented by a rising scale of numbers from 0 to 4.

Fahmi (T.). **A technical method of selection in Cotton for immunity against wilt.**—*Egypt. agric. Rev.*, xix, pp. 6–17, 1941. [Arabic. Abs. in *Plant Breed. Abstr.*, xii, 1, p. 59, 1942.]

With a view to the development of cotton strains combining

productivity and other desirable characters with immunity from wilt [*Fusarium vasinfectum*], seedlings are planted in pots containing contaminated soil, which are kept for 40 days in a greenhouse at 25° C. At the end of this period, the apparently healthy plants are set out in the field, where they are bred for several generations until the requisite qualities become firmly established. The best stock for the object of these experiments is produced by artificial hybridization between carefully selected immune and non-immune varieties.

Boughey (A. S.). **Cotton seed disinfection in war-time.**—*Nature, Lond.*, cxlix, 3767, pp. 50–51, 1942.

In an attempt to find an alternative measure for the control of blackarm disease of cotton (*Bacterium* [*Xanthomonas*] *malvacearum*) [*R.A.M.*, xx, p. 162] to mercurial dusts, a shortage of which is anticipated in war-time, cotton seed in the Sudan was steeped for 48 hours in four times its own weight of irrigation water. As a result, all traces of external infection disappeared and no infection occurred in subsequent small-scale greenhouse experiments with seed which, when untreated, gave 14 per cent. infected plants. In the field, infected seed from the same source showed 0·26 per cent. infected plants after the steeping treatment, while complete control was obtained with a mercurial dust, abavit B. The germination of the steeped seed was only slightly depressed in comparison with untreated, the germination percentages in the field being 72 and 79, respectively. If the steeped seed cannot be sown wet immediately, it should be dried rapidly and thoroughly before storing, as otherwise the seed germinates promptly. The conclusion drawn from this experiment is that the organism disappears from the surface of the seed during steeping, not through the activity of a bacteriophage, but through exposure to anaerobic conditions resulting from bacterial activity and oxygen absorption by the germinating seed.

Blanco (M. C.). **Las micosis broncopulmonares. Su importancia clinica.** [The bronchopulmonary mycoses. Their clinical importance.]—*Bol. Inst. Clín. quirúrg., B. Aires*, xvi, 137, pp. 787–930, 41 figs., 1940. [Abs. in *Trop. Dis. Bull.*, xxxviii, 12, pp. 730–731, 1941.]

The first of the 13 chapters of this important monograph deals with the history of mycoses since Malpighi's studies in the latter part of the 17th century; the second with the morphology, biology, reproduction, and classification of the fungi concerned in the etiology of these diseases, which are divided into three groups, (1) fungi with blastospores, comprising two families, Saccharomycetaceae and Torulopsidaceae, (2) fungi with astrospores, and (3) filamentous fungi, including Actinomycetaceae with slender hyphae, and Mucoraceae and Aspergillaceae with thick ones; successive chapters are devoted to pathogenesis, pathological anatomy, symptomatology, differential diagnosis, clinical forms, associated diseases, and therapy (mainly by potassium iodide). Pulmonary mycosis, at any rate in the Argentine, is by no means a rarity and its incidence is on the increase. Some of the fungi responsible are true parasites, others 'pseudoparasites' capable of assuming a

pathogenic character where the condition of the host tissues favours such a change.

Foley (M. P.), Love (J. G.), Broders (A. C.), & Heilman (F. R.). **Coccidioidal granuloma. Report of a case originating in Texas.**—*West. J. Surg.*, xlviii, 12, pp. 738–741, 5 figs., 1940.

*Coccidioides immitis* developed in dextrose agar cultures of material from the sinus behind the right ear and from portions from the cranial bone of a 33-year-old male on whom a successful operation was performed at the Mayo Clinic, Rochester, Minnesota, for the removal of the granuloma produced by the fungus. Attention is drawn to the two phases of *C. immitis*, namely, the parasitic, characterized by the production in the host tissues of double-contoured bodies filled with endospores, and the vegetative, on artificial media under aerobic conditions, represented by branched, septate, flocculent mycelia and chlamydospores. Stress is further laid on the close resemblance of the fungus, both in its macroscopic and microscopic features, to *Mycobacterium tuberculosis*. *C. immitis* was reisolated from the small, white, tubercle-like nodules developing in the lungs and other organs of intraperitoneally inoculated mice.

Yoh (T.). **Über die Trichophytie in Formosa. I. Mitteilung : über die Kopftrichophytie in Nordformosa.** [On trichophytosis in Formosa. Note I: on trichophytosis of the scalp in north Formosa.]—Abs. in *Jap. J. Derm. Urol.*, xlix, 2, pp. 11–12, 1941.

*Microsporum ferrugineum* [*R.A.M.*, xviii, p. 522] was ascertained to be the most frequent agent of superficial trichophytosis of the scalp in north Formosa, having been responsible for the condition in 293 out of 388 cases examined in the native elementary schools and among outpatients of the Taihoku University Clinic; 68 yielded *Trichophyton violaceum*, 23 *T. coccineum* [ibid., xix, p. 705], one each *T. glabrum* and *T. gypseum* var. *radiolatum*, and two unidentified strains. Of four cases of deep-seated ringworm, two were shown to be due to *M. ferrugineum* and one each to *T. coccineum* and *T. glabrum*.

*T. coccineum*, first recognized by Y. Kato in Kyushu, and since observed on the Japanese mainland, Korea, Formosa, and China, forms on Sabouraud's maltose agar brownish-red to purple colonies, intersected after 18 days' growth by over 30 radial and a few circular grooves. On glucose agar the cultures are of a drier and more powdery consistency, sometimes barely distinguishable from those of *T. purpureum*. Pigmentation becomes progressively fainter in subcultures, and is absent on peptone agar. Spindle spores with 2 to 6 septa were first detected by the writer. Infection by *T. coccineum* is readily communicable to guinea-pigs.

Takahashi (S.) & Yoh (T.). **Über die Trichophytie in Formosa. II. Mitteilung : über die Kopftrichophytie in Mittelformosa.** [On trichophytosis in Formosa. Note II: on trichophytosis of the scalp in central Formosa.]—Abs. in *Jap. J. Derm. Urol.*, xlix, 3, p. 23, 1941.]

As in northern Formosa [see preceding abstract], *Microsporum*

*ferrugineum* is the most frequent agent of superficial ringworm of the scalp in the central districts, having been identified in 583 out of 992 cultures, followed by *Trichophyton violaceum* (311), *T. coccineum* (67), and *T. glabrum* (31), while all seven cases of deep-seated ringworm were caused by *M. ferrugineum.* The admixture of favus was observed in five cases of superficial trichophytosis and double '*Trichophyton*' infections in 45. Three cases of the former yielded *M. ferrugineum* and *Achorion schoenleini*, and one *T. glabrum* and *A. formosensis* Hasegawa, while *M. ferrugineum* and *T. violaceum* were implicated in the latter.

Araki (M.). **Über das Auftreten von Weinranken in Trichophytonstämmen.** [On the development of 'vine tendrils' in *Trichophyton* strains.]—Abs. in *Jap. J. Derm. Urol.*, xlix, 2, pp. 12–13, 1941.

The writer carried out a study on the development of 'vine tendrils' (Bodin's 'vrilles') in various species of *Trichophyton* with a view to determining the mechanism of this hitherto unexplained phenomenon or the factors involved in its appearance. 'Tendril' formation is already familiar in *Sabouraudites asteroides* [*T. mentagrophytes*] and *S. interdigitalis* [*T. interdigitale*], and in the present investigations it was further observed in *Epidermophyton inguinale* [*E. floccosum*] and *S. ruber* [T. *rubrum*]. The spiral mode of growth, culminating in 'tendrils' at the hyphal tips, is tentatively attributed to the lack of sufficient available nutrient to supply the requirements of the actively growing mycelium.

Cutting (W. C.) & Gebhardt (L. P.). **Inhibitory effects of sulfonamides on cultures of Actinomyces hominis.**—*Science*, N.S., xciv, 2450, pp. 568–569, 1941.

Aerobic and anaerobic cultures of two strains of *Actinomyces hominis* [*R.A.M.*, xv, p. 650] were almost completely inhibited by sulphanilamide at concentrations of 50 and 100 mg. per cent., and partly so at one of 10 mg. per cent. At similar concentrations sulphathiazole and sulphadiazine were even more effective.

Carrera (C. J. M.). **La presencia de 'Fusarium scirpi v. acuminatum' en la República Argentina.** [The presence of *Fusarium scirpi* var. *acuminatum* in the Argentine Republic.]—*Rev. argent. Agron.*, vii, 2, pp. 89–94, 3 figs., 1941.

In October, 1938, Dr. Maria Campi isolated from carnations at Buenos Aires two species of *Fusarium*, viz., *F. equiseti* and *F. scirpi* var. *acuminatum* [*R.A.M.*, xx, pp. 246, 353], of which the latter was experimentally shown to be pathogenic to Klein 11 flax, grown in pots containing sterilized soil, superficially covered with a wheat grain culture of the fungus. The organism previously described by Bolley and Manns as *F. russianum*, and implicated by them in the etiology of flax 'sickness' in the United States [ibid., xii, p. 220], has been relegated by Wollenweber [ibid., xiv, p. 708] to synonymy with *F. scirpi* var. *acuminatum.* It was a much milder parasite in the author's experiments than *F. lini*, while *F. terrestris* Manns (since reduced to synonymy with *F. equiseti* var. *bullatum* [ibid., xix, p. 168]) was non-pathogenic. The importance of the detection of *F. scirpi* var. *acuminatum* on such apparently unrelated hosts as carnation and flax lies in the opportunity

afforded to the pathogen for multiplication in the former to the detriment of the latter.

NELSON (R. H.) & CASSIL (C. C.). **Adsorption of mercuric chloride from solution by Gladiolus corms.**—*Circ. U.S. Dep. Agric.* 610, 10 pp., 1941.

Mercuric chloride is widely used by growers in the United States as a preventive of corm-borne diseases and pests of gladioli, and the experiments herein fully described and tabulated were conducted to determine, by precise chemical analysis, the amount of the chemical removed from solution by unpeeled corms immersed for varying lengths of time. It was found that a capacity load of corms in a burlap sack soaked for seven hours and upwards drained 50 per cent. or more of the mercuric chloride from a 1 in 1,000 solution. In 17-hour comparative tests at 60° and 73° to 75° F., the quantity of the chemical removed from the solution was considerably larger at the higher temperature (0·66 as compared with 0·55 gm. per l.). Corm size did not affect the extent of adsorption of the chemical. In an immersion period of 24 hours some 31 per cent. of the initial 1 gm. per l. of mercuric chloride is taken up by the sack, and the remaining 20 per cent. or more adsorbed by the corms, the thin tunic scales withdrawing four to ten times as much from the solution as the corms proper. The addition of half the initial amount of mercuric chloride to solutions previously used for a 17-hour soaking failed to restore them to the requisite concentration, and it was not found possible to devise a rule-of-thumb method for the maintenance of the solution at the correct strength for re-use. Growers should therefore either prepare a fresh solution for each load of corms, or re-charge the original one on the basis of the results of the potassium iodide test recommended for a similar purpose in connexion with potato disinfection in *Leafl. N.Y. St. Coll. Agric.* (unnumbered), 1931 [cf. *R.A.M.*, xi, p. 671], the test being made, however, after each treatment instead of after two, as in the case of potatoes.

TOMPKINS (C. M.) & MIDDLETON (J. T.). **A mosaic disease of Primula obconica and its control.**—*J. agric. Res.*, lxiii, 11, pp. 671–679, 3 figs., 1941.

A mosaic disease of *Primula obconica*, first observed in greenhouses at San Francisco in 1937, is stated to have caused serious losses affecting from 5 to 25 per cent. of seedlings. The disease is characterized by a prominent leaf mottle, consisting of irregular, dark green islands on a light green to yellow background, upward curling and cupping of the leaves with occasionally a shoestring effect at or near the tip, severe stunting of the whole plant and dwarfing of leaves, petioles, and peduncles, a conspicuous colour-breaking or variegation of the petals and calyx-mottling in the infected flowers. The virus proved readily transmissible by juice inoculation with carborundum, the incubation period ranging from 16 to 21 days. All attempts to transmit the virus by means of the aphids *Myzus persicae* and *M. circumflexus* in the greenhouse were unsuccessful. The virus retained its infectivity after ageing for only 24 hours at 22° C., was inactivated by ten minutes'

heating at 50°, and had a dilution tolerance of 1 to 10. The host range of the virus appears to be limited to the original host, *P. malacoides*, and *P. sinensis*, no infection resulting from mechanical inoculation of 46 other plants representing 42 genera in 23 families. The disease was eradicated from greenhouses at San Francisco by careful roguing of diseased plants and weekly fumigation of the houses with nicotine dust.

KEVORKIAN (A.). **Enfermedades de las Orquideas.** [Orchid diseases.]—*Rev. Agric. P. Rico*, xxxii, 3, pp. 345–346, 1940.

In this paper (translated into Spanish by R. R. Cuitrón), the author gives popular notes on the following orchid diseases and their control: anthracnose (*Gloeosporium* and *Colletotrichum* spp., any one of 36 of which may be responsible), leaf spots caused by *Phoma*, *Macrophoma*, *Diplodina*, *Hendersonia*, and *Cercospora* spp.; rusts (*Uredo* and *Puccinia* spp.) on species of *Cattleya*, *Cypripedium*, *Epidendrum*, and others; rhizome infections (*Phytophthora* and *Fusarium*), the former particularly affecting species of *Cattleya* and *Vanda*; and root rot (*Sclerotium rolfsii*).

TOMPKINS (C. M.) & ARK (P. A.). **Verticillium wilt of Strawflower.**—*Phytopathology*, xxxi, 12, pp. 1130–1134, 3 figs., 1941.

In 1938 a severe wilt of strawflower (*Helichrysum bracteatum*) caused the loss of about one-third of the marketable crop in San Mateo County, California, where in the two succeeding years the damage from the same source amounted to half and two-thirds, respectively. Comparable losses were sustained elsewhere in the same county and smaller ones in Santa Barbara County. The disease is characterized by wilting of the foliage, proceeding from the base upwards and followed by chlorosis, the development of brown, necrotic, coalescent areas, and ultimate desiccation, the leaves remaining attached to the stem but hanging in a vertical position. An apical whorl of turgid leaves, unaffected by the wilt, may sometimes be observed. The vascular tissues of the roots and stem show a blackish-brown discoloration, extending for a considerable distance above soil-level, while early infection reduces the length of the stem internodes, with consequent stunting of the plants. The infected plants are scattered throughout the fields, which present a scorched aspect from a distance. In cases of severe infection (the average in most fields is 90 to 100 per cent.), less than 5 per cent. No. 1 grade flowers are available for processing and marketing, and the loss to growers is therefore considerable.

*Verticillium albo-atrum* [*R.A.M.*, xx, p. 118] was isolated from the diseased tissues on Czapek's and potato dextrose agar and inoculated with positive results into its own host, Acala cotton, eggplant, and sunflower. Monospore cultures of some of the isolates segregated into two groups, conidial and mycelial (Hansen's 'dual phenomenon' [ibid., xvii, p. 830]), both of which were equally pathogenic. Evidence of the transmission of the fungus by way of the seed was not forthcoming, so that control may be effected by the use of clean soil. In 1940 a small field of strawflowers at Montara not hitherto planted with the crop remained free from the disease.

Presley (J. T.). **Saltants from a monosporic culture of Verticillium albo-atrum.**—*Phytopathology*, xxxi, 12, pp. 1135–1139, 2 figs., 1941.

On a synthetic mineral-agar medium enriched with asparagin (1·5 gm.) and dextrose (20 gm.), monospore cultures of *Verticillium albo-atrum*, originally isolated from a chrysanthemum plant at St. Paul, Minnesota, developed such a striking diversity of saltants, ranging from black to pure white, from very fluffy to completely submerged, and with or without microsclerotia of varying sizes, as to call in question the validity of some of the so-called morphological characters used to separate this species from *V. dahliae*. All Van Beyma thoe Kingma's forms [*R.A.M.*, xix, p. 367] appear to be represented in the writer's series of cultures, so that both the dark mycelial colonies commonly associated with *V. albo-atrum* and the abundant microsclerotia typical of *V. dahliae* [ibid., x, p. 757 *et passim*] are obtainable from a monospore culture of the former. It is suggested that the cultural changes reported by various workers may well have occurred as a result of sectoring and unconscious selection towards a type, of which the raised, white growth would be more easily manipulated than the black mycelium, in successive transfers of the fungus.

Gäumann (E.). **Zur Kenntnis einiger Gräser-bewohnenden Uromyces-Arten.** [A contribution to the knowledge of some herbicolous species of *Uromyces*.]—*Phytopath. Z.*, xiii, 5, pp. 505–516, 1941.

The results of cross-inoculation experiments at the Federal Technical Institute, Zürich, with *Uromyces dactylidis* from *Dactylis glomerata* on 17 species of *Ranunculus* disclosed the existence, in addition to the five physiologic races of the rust already known, of a sixth on *R. repens*, to which the name of f. sp. *repenti-dactylidis* is applied. The new race also infects *D. aschersoniana*. The strain of *U. dactylidis* from *R. valdepubens* (a subspecies of *R. bulbosus*) infected only these two out of six species tested, thereby confirming the validity of Plowright's (*Quart. J. micr. Sci.*, N.S., xxv, pp. 151–172, 1885) f. sp. *bulbosi-dactylidis*, to which *D. aschersoniana* is likewise susceptible.

On a similar basis of cross-experimentation three physiologic races of *U. festucae* are distinguished, viz., f. sp. *rubrae* which is only able to infect *Festuca rubra*, f. sp. *ovinae* Bubák on *F. duriuscula*, but also capable of infecting *F. capillata* and *F. ovina*, and f. sp. *rupicaprina* on *F. rupricaprina*, infecting that host and *F. halleri*, while the seven physiologic races already known of *U. poae* [*R.A.M.*, xix, p. 303] are supplemented by an eighth, f. sp. *repenti-pratensis*, with its aecidial and teleutospore stages on *R. repens* and *Poa pratensis*, respectively, *P. angustifolia* also being susceptible.

Sprague (R.). **Some leaf spot fungi on western Gramineae.**—*Mycologia*, xxxiii, 6, pp. 655–665, 1 fig., 1941.

Notes are given on nine incompletely known or hitherto undescribed species of fungi causing leaf spots of grasses in western parts of the United States, including *Phyllosticta owensii* n. sp. (associated with *Scolecotrichum graminis*) on living, dead, or salt spray-injured leaves of *Dactylis glomerata*; *P. anthoxella* (associated with *Colletotrichum graminicola* and *Titae* sp.) on dead basal leaves of *Anthoxanthum odoratum*;

*P. roglerii* n. sp. (associated with *C. graminicola*) in living leaves of *Digitaria sanguinalis*; and *P. sorghina* (syn. *P. sacchari*, *P. setariae*, *P. glumarum-sorghi*, *P. glumarum-setariae*, *P. phari*, *P. penicillariae*, and *Phoma insidiosa*) on *Setaria viridis* and *Tricholaena rosea*. *Phyllosticta sorghi* Anzi (on *Sorghum saccharatum* and *S. vulgare*) is an older name than *P. sorghina*, but was not validly established, as no pycnidia or spores were described.

SPRAGUE (R.). **A blotch and char-spot of western grasses.**—*Northw. Sci., Wash.*, xv, 4, pp. 81–85, 1 fig., 1941.

*Septogloeum oxysporum* Bomm., Rouss., & Sacc. produces on various grasses in western North America tawny, yellow-edged, circular, later elliptical to elongated lesions, which become covered with dull black, charcoal-like streaks, 2 to 5 mm. wide and often several times as large. The centre of the lesion is frequently of a pale grey or isabelline shade; pycnidia may sometimes be detected as small, black dots along the margin, but they are more often observed by the charcoal-like stromata. Isolations of the fungus from *Arrenatherum elatius* [*A. avenaceum*] at the Oregon Agricultural Experiment Station on potato dextrose agar at 40° F. made rather slow growth, the colonies being pale buff with tawny shades. The non- to tri-, mostly bi-septate, yellow to subhyaline, fusoid conidia are often slightly flattened on one side, subtruncate at the base, tapering towards an obtusely pointed apex, and arise from hyaline, globular or subcuspidate conidiophores, their dimensions in the 20-odd collections examined by the writer ranging from 17 to 23 by 2·7 to 3·9 $\mu$ to 29 to 33 by 4·4 to 47 $\mu$. The pycnidia found on four of the specimens were subglobose, brown, 80 to 160 $\mu$ in diameter, and provided with ostioles up to 60 $\mu$ in diameter; the pycnospores resembled the conidia arising from the creosote-brown stromatic tissue except in their virtual absence of colour. Perithecia of the fungus are globose to very strongly flattened, up to 250 $\mu$ in diameter; nearly mature asci, short, fasciculate, and aparaphysate, were observed in material from *Elymus condensatus*. Other hosts of *S. oxysporum* include *Agropyron spicatum*, *Agrostis hallii*, *Calamagrostis inexpansa*, *Bromus ciliatus*, *Distichlis stricta*, and *E. glaucus*, the States yielding specimens, besides Oregon, being North Dakota, Colorado, California, Wyoming, Washington, and Utah.

The confused taxonomy of the fungus is fully discussed and its synonyms listed as *Mastigosporium album* var. *athrix* Eriks., *Fusoma biseptatum* Sacc., *F. triseptatum* Sacc., *F. psiliense* Bres. & Vesterg., and *S. athrix* (Eriks.) Sprague [*R.A.M.*, xviii, p. 34]. It is expected that the organism will eventually be assigned to a *Dothidella*-like genus, being akin to, if not identical with, *D. aristidae* (syn. *Phyllachora aristidae*, *Dothidea aristidae*).

HANSING (E. D.) & LEFEBVRE (C. L.). **Smut sori from ovarial and staminal tissues of certain grasses.**—*Phytopathology*, xxxi, 11, pp. 1043–1046, 2 figs., 1941.

Wide variations were observed in 1935–6 in the size and shape of the sori of certain smuts produced on different organs of native Kansas

grasses of the Andropogoneae, such discrepancies being particularly marked in the case of *Sorosporium everhartii* on *Andropogon furcatus* [*R.A.M.*, xviii, p. 11], on which the staminal tissues bear much smaller and more slender sori than those formed in the ovaries. Of all the sori produced in the latter region, 39 per cent. in a collection of 148 spikelets and 32 per cent. in one of 219 developed in the pedicellate staminate spikelets, i.e., from rudimentary ovaries which are normally sterile; these sori were almost as large as those arising from the corresponding tissues of the sessile, normally fertile spikelets. In individual spikelets, sessile or pedicellate sori may develop from ovarial tissue or staminal primordia only, or from ovarial tissue and one, two, or three staminal primordia, staminal sori apparently showing a greater tendency to develop in the pedicellate than in the sessile spikelets.

Sorghum infected by *Sphacelotheca sorghi* and *S. cruenta* also bore sori from both the staminal and ovarial tissues, the tips in some cases being compound, i.e., made up of four parts, three staminal and one ovarial, which are united below to form the usual simple base. Even the sori with simple tips appear to have originated from both types of tissue and the parts united at a very early stage of development. The first-named author (unpublished thesis of the Kansas State College of Agriculture) found that 50 per cent. of the pistillate sori of *S. occidentalis* on *A. furcatus*, and of *S. cruenta* on *Sorghum halepense* were in the pedicellate spikelets. The male inflorescence of maize is often found to be attacked by *Ustilago zeae* and *Sorosporium reilianum*.

NEILL (J. C.). **Britain wants ergot from N.Z. !**—*N.Z. J. Agric.*, lxiii, 5, pp. 397–398, 3 figs., 1941.

Directions are given for the collection by schoolchildren of ergots [*Claviceps purpurea*: *R.A.M.*, xxi, pp. 2, 135], which occur on many different grasses in New Zealand, the most valuable kind being found on tall fescue [*Festuca* sp.].

BELL (J. E.). **How to harvest and clean ergot.**—*N.Z. J. Agric.*, lxiii, 5, pp. 399–400, 4 figs., 1941.

Ergot [*Claviceps purpurea*: see preceding abstract] is ready for collection from tall fescue [*Festuca* sp.] in New Zealand from December onwards. It can be harvested by cutting off the heads or by hand-stripping them. Cut heads should be well dried by being stood on end in the sun or spread out on the ground, or on sheets of iron, bags, or canvas. The ergot is then threshed by tapping the heads against a piece of wood. Hand-stripped ergot should be laid out to dry on sheets of any suitable material. The mixed ergot and grass seed is then winnowed, care being taken not to damage or break the ergot. In the absence of a machine, winnowing can be effected by throwing the material several times in a draught of wind, when the ergot will fall close to the thrower, and the lighter seed, straw, and dust farther away. Alternatively, the mixed ergot and rubbish can be thrown into a pail of water and the undesired material floated off. The ergot should at once be dried in the sun and placed in air-tight tins, ready for sale to the produce merchant.

NATH (P.) & PADWICK (G. W.). **Ergot in India.**—*Curr. Sci.*, x, 11, pp. 488–489, 1941.

Ajrekar has suggested that *Sphacelia sorghi*, the agent of a sorghum disease in India, is the imperfect stage of a species of *Claviceps* [*R.A.M.*, vi, p. 91]. In the autumn of 1941 the senior author observed a severe attack of ergot near Simla, at an altitude of 6,500 ft., on three grasses, viz., *Brachypodium sylvaticum*, *Oplismenus cosmopolitus*, and *Andropogon? gryllus*, the dimensions of the sclerotia on which were up to 35 by 1·5 to 2 mm., 9 by 1 to 1·5 mm., and 14 by 1 to 1·5 mm., respectively, and their colours 'dusky brown' (Ridgway) externally and pale pinkish-cinnamon internally, 'chaetura black' externally and white internally, and 'sooty black' externally and white internally, respectively, while the conidia measured 2·1 to 7·8 by 1·8 to 3·9 (mean 5·5 by 2·9) $\mu$, 3·9 to 6·1 by 1·8 to 2·8 (5·2 by 2·0) $\mu$, and 3·6 to 11 by 1·8 to 4·6 (5·6 by 3·0) $\mu$, respectively. The fungus concerned is thought to be a species of *Claviceps*, probably *C. purpurea* or *C. pusilla* [ibid., xxi, p. 82], the relatively large conidial dimensions being in favour of the latter species.

GILLESPY (T. G.). **Studies on the mould Byssochlamys fulva (III).**—*Rep. Fruit Veg. Pres. Sta., Campden, 1940*, pp. 54–61, 3 graphs, 1941.

Experimental data are reported showing that, in suspending media of bottled fruit liquid or citrate buffer solutions below $P_H$ 3·7, the asci of *Byssochlamys fulva* [*R.A.M.*, xix, p. 227] were much more susceptible to heat in the presence of small concentrations of sulphur dioxide. Thus, a temperature of 170° F. was much more lethal to the mould in a medium containing 10 p.p.m. sulphur dioxide than one of 185° without the compound, and similarly 180° was nearly as effective as 190°. With 2 p.p.m. sulphur dioxide, a temperature of 185° was almost as destructive as one of 190° without it. Expressed in terms of time, at 170°, 175°, and 180°, 10 p.p.m. sulphur dioxide reduced the period requisite for the extermination of 200 asci per ml. from infinity to 29, 20, and 14 minutes, respectively, and at 185° and 190° from 45 to 10 and from 13 to 5½ minutes, respectively; at 185° and 190°, 2 p.p.m. curtails the corresponding period from 45 to 14 and from 13 to 6 minutes, respectively. Tentative experiments showed sodium thiosulphate to be about one-third, and sodium hyposulphite twice, as effective against *B. fulva* as sodium sulphite.

WEBER (G. F.). **Thread blight of woody plants.**—*Pr. Bull. Fla agric. Exp. Sta.* 551, 2 pp., 1940.

Among the many hosts of thread blight (*Corticium stevensii*) recognized in Florida since 1900 are pear, pecan, fig [*R.A.M.*, xix, p. 294], persimmon, citrus, guava, and tung oil trees [*Aleurites*]. The fungus causes partial or total defoliation and attacks the fruits, and by means of its sclerotia, which are resistant to unfavourable environmental conditions, it is perpetuated for several years on the host twigs. These organs are formed during the dormant period round the terminal and lateral buds and along the internodes, where they are suitably located to give rise to spores and thereby initiate new infections when new

growth is resumed. Satisfactory control of thread blight has been secured by a combination of pruning and spraying with 4–4–50 Bordeaux mixture.

SOUTHWICK (F. W.) & CHILDERS (N. F.). **Influence of Bordeaux mixture and its component parts on transpiration and apparent photosynthesis of Apple leaves.**—*Plant Physiol.*, xvi, 4, pp. 721–754, 4 graphs, 1941.

Experiments [which are fully described] made to determine the rates of transpiration and apparent photosynthesis of apple leaves sprayed with Bordeaux mixture under different conditions of temperature, light, humidity, and soil moisture demonstrated that applications of the spray exercised, at least temporarily, a retarding influence on photosynthesis, regardless of temperature, humidity, light intensity, or soil moisture conditions. In the absence of visible injury (which developed at 50° and 60° F.), however, the rate of photosynthesis returned to normal whenever the spray residue was removed from the leaves.

The evidence also showed that some days after the applications of Bordeaux mixture had been made, the rate of carbon dioxide absorption returned to normal, even when the spray residue was not removed from the leaves. It would, therefore, seem that the primary retarding influence of Bordeaux mixture on apple leaves was due, not to mechanical shading, but to some physiological effect produced by the mixture.

As hydrated lime did not appear to exercise a detrimental effect on the rate of photosynthesis, while copper sulphate retarded it, it was assumed that the copper fraction in the Bordeaux mixture was the chief cause of the reduced photosynthesis. The diffusion of copper into the leaf tissue could occur only if copper were present in a soluble form. It might, therefore, seem that no soluble copper would be present in Bordeaux mixture (4–6–100), which contains more than sufficient lime to precipitate all the copper sulphate present. To clear up this point, experiments were made with Bordeaux mixture (4–6–100), hydrated lime (0–6–100), and copper sulphate (4–0–100) and it was found that starch was retained in the leaves treated with copper sulphate long after it had escaped from the controls. A few of the Bordeaux-treated leaves appeared to contain starch after none was present in the controls, but in no case were the results as marked as in the leaves treated with copper sulphate. The leaves sprayed with hydrated lime did not appear to retain starch longer than the controls.

The temperature at which Bordeaux mixture may be expected to cause visible injury to apple foliage would appear to lie between 60° and 70°.

Bordeaux mixture and its component parts appeared to have either no effect, or a retarding one, on transpiration rate. The general effect of the mixture on young apple trees growing under low soil moisture conditions was slightly to reduce the transpiration rate.

KEITT (G. W.) & LANGFORD (M. H.). **A preliminary report on genetic studies on pathogenicity and the nature of saltation in Venturia inaequalis.**—*Phytopathology*, xxxi, 12, p. 1142, 1941.

At the University of Wisconsin two classes of monosporous isolates

of *Venturia inaequalis* [*R.A.M.*, xix, p. 548] were studied for their pathogenicity to certain differential apple varieties in the greenhouse: (1) 'lesion', inciting typical sporulating lesions, and (2) 'fleck', giving rise to yellowish flecks with few or no spores. Crosses were made *in vitro* and the eight ascospores from an ascus of each progeny were cultured and the pathogenicity of their lines investigated. Lesion × lesion produced eight lines lesion, fleck × fleck eight lines fleck, and lesion × fleck, four lines of each type. Certain sector lines were shown to differ genetically from their parents. The original monoascosporous lines D5 × D8 (both pathogenic) produced eight-spored asci, giving rise to eight pathogenic lines, while the eight-spored asci from D5 × D8 sector (non-pathogenic) segregated into four pathogenic and four non-pathogenic lines and D5 × sector from D8 sector (non-pathogenic) fell into two pathogenic and six non-pathogenic lines. Certain crosses of non-pathogenic sector lines with pathogenic lines yielded four-spored asci, of which the four lines showed the same pathogenic reactions as the pathogenic parent. In the absence of any possibility of heterocaryosis the sectors are presumed to have arisen through mutation.

KEITT (G. W.) & LANGFORD (M. H.). **Venturia inaequalis (Cke.) Wint. I. A groundwork for genetic studies.**—*Amer. J. Bot.*, xxviii, 9, pp. 805–820, 12 figs., 1 graph, 1941.

In studies designed to serve as a groundwork for further genetic investigations of *Venturia inaequalis* [see preceding abstract] in relation to basic pathological problems, experiments were conducted to determine the cultural behaviour, sexual compatibility, and pathogenicity of four sets of monoascosporic isolates, each set comprising eight isolates from a single ascus with record of the serial order of the spores.

The isolates were cultured under standardized conditions by successive monosporic transfers on malt agar plates. According to colony characters, the eight isolates of each set comprised four groups, each consisting of a pair of like isolates. Each of the 16 pairs was distinguishable from every other pair by colony characters, but the two members of any pair could not be differentiated by any test applied. During three years the differential cultural characters of all the lines remained highly constant.

The fungus was bred *in vitro* in plates of malt agar containing dead apple leaf decoction. Perithecial initials appeared when the cultures were about four weeks old. Grown separately, each isolate produced both antheridia and ascogonia, but the perithecial initials generally remained small and in no instance produced asci. Mixing of the conidial suspensions of the two isolates to be paired in the Petri dish before pouring in the agar proved far more effective than streaking or planting the inoculum on the medium. Ascogonia may be produced by both isolates of a pairing but usually more freely by one than the other. Several antheridia were usually appressed to the trichogyne of each ascogonium. The perithecia of most pairings reached a maturity peak after four to five months. All the isolates studied were hermaphroditic and self-incompatible. The eight isolates from each ascus fell into two groups of four, one group intra-group incompatible and the other intra-

group compatible and the 32 isolates from four sets comprised the two above-mentioned groups of 16 isolates each.

When the pathogenicity of the 32 isolates was tested under partly controlled greenhouse conditions on leaves of nine apple varieties, in each set all eight isolates caused typical sporulating lesions on one or more varieties, while on others some isolates caused sporulating lesions and other isolates did not. On differential varieties four isolates of a set generally produced typical lesions, and the other four caused flecks. On the whole, the pathogenicity of the 32 lines neither increased nor diminished during three years' study.

Sector lines showed cultural characters and pathogenic reactions different from those of the original lines. These characters remained comparatively constant, and no sector line reverted to the type of line from which it came.

The data obtained in this and earlier studies [loc. cit.] demonstrate that the third nuclear division in the ascus of *V. inaequalis* is equational and that segregation of factors for pathogenicity and sexual compatibility, respectively, may take place in the first or second nuclear division. The work of Keitt and Palmiter (*Amer. J. Bot.*, xxv, pp. 338–345, 1938) and Keitt, Palmiter, and Langford (abs. in *Phytopathology*, xxviii, 12, 1938) appears to be the first case of segregation for pathogenicity to be experimentally demonstrated for an Ascomycete.

Smock (R. M.) & Watson (R. D.). **Ozone in Apple storage.**—*Refrig. Engng*, xlii, 2, pp. 97–101, 3 figs., 1941.

In experiments at Cornell University, Ithaca, New York, the introduction of 1 to 2 parts per million of ozone into the storage room for one to two hours daily controlled the growth of various rot fungi on McIntosh apples, e.g., *Sclerotinia fructicola*, *Penicillium expansum* and other *P.* spp., *Botrytis cinerea*, and *Cephalothecium* [*Trichothecium*] *roseum*. Used continuously at the rate of 15 p.p.m. at a temperature of 40° F., it reduced the number of spores per cu. yd. of atmosphere from 4,280,000 to 2,760. Exposure of wet spores of *S. fructicola* and *P. expansum* to 0·6 p.p.m. of ozone for 2½ hours at room temperature with a relative humidity of 85 to 90 per cent. completely plasmolysed them. None of the varieties tested suffered any injury from the ozone treatment at 32° for the prescribed period of an hour or two daily at concentrations of 2 to 3 p.p.m., but the sensitive Golden Delicious is liable to develop a blackening of the skin round the lenticels on exposure to unduly high doses. The effects of ozone on scald in Rhode Island Greenings are not clear-cut, but there is some indication of a reduction in the intensity of the defect from the treatment [*R.A.M.*, xx, p. 68].

Fitzpatrick (R. E.) & Woodbridge (C. G.). **Boron deficiency in Apricots.**—*Sci. Agric.*, xxii, 4, pp. 271–273, 1 pl., 1941.

In the spring of 1935, 13 one-year-old apricot trees were planted in iron tubs filled with sand from the shore of Lake Okanagan, at Summerland, British Columbia. Throughout the remainder of the year and 1936 the sand was watered with a nutrient solution made chiefly from commercial fertilizer materials, no boron being added. In the spring of 1937 the trees were divided into two groups, six trees being given a

complete nutrient ration made from C.P. salts, supplemented with boric acid, while the remainder received the same ration, without boron.

The trees continued to thrive in 1937, 1938, and 1939, but in 1939 the boron content of the fruit from the trees not receiving this element showed a marked drop. In the following spring (1940) all these non-boron-treated trees developed deficiency symptoms [cf. *R.A.M.*, xix, p. 30]. In the worst cases the terminal twigs died back. Where this was noted the twigs appeared healthy in early spring, but the buds either failed to develop or died at the green tip stage. The cambium and bark succumbed shortly after, and the twigs shrivelled progressively from the tips. Two trees died in this manner without developing any foliage, two, though severely affected, developed some leaves, while the remainder showed symptoms only in the first leaves. Some leaves, from buds that had only sufficient vitality to develop past the green-tip stage, were much dwarfed, spatulate, and curled up at the margins; most began to blacken at the tip shortly after unfolding, and finally they shrivelled and dropped off. In general, the leaves were brittle, narrow, and pale between the veins. Occasionally, the midrib and main lateral veins were thickened, and the leaves often assumed a boat-like form. Characteristically, the effects occurred together in the same tree, certain branches dying back, while others remained more or less normal. No fruit developed on the trees untreated with boron.

Similar die-back and foliage symptoms were seen in several apricot orchards in the Okanagan Valley in the spring of 1940. Chemical analysis of the twigs of one affected tree showed that the boron content was 4·5 p.p.m., that of two healthy trees being 20·8 and 20 p.p.m., respectively. In one affected block the trees were sprayed in May with boric acid solution (4 lb. per 100 gals. water), with the result that recovery ensued.

Traub (H. P.), Pomeroy (C. S.), Robinson (T. R.), & Aldrich (W. W.). **Avocado production in the United States.**—*Circ. U.S. Dep. Agric.* 620, 28 pp., 7 figs., 1941.

Included in this circular are brief notes on the principal diseases of the avocado and their control in the United States, reference to which has already been made [*R.A.M.*, xiv, p. 707; xx, p. 483, *et passim*].

Kreutzberg (V. E.). **A new virus disease of Pistacia vera L.**—*C. R. Acad. Sci. U.R.S.S.*, N.S., xxvii, 6, pp. 614–617, 3 figs., 1940.

A new virus disease of the rosette type was observed on a wild pistachio tree (*Pistacia vera*) in Turkoman in 1935, and was later found occurring in the same forest belt stretching into Uzbekistan and Tadjikistan. It is believed to occur also in the adjoining regions of northern Afghanistan and northern Iran. In pistachio plantations in the Kushkinskaya forest an average of 62 per cent. of trees was infected, the disease affecting 13·2 per cent. of the branches in the crown. The yield of affected individual trees was reduced by 45·2 per cent., the average decrease in the yield of the whole plantation being 34·72 per cent. The infected trees are depressed in growth and form rosettes of varying size (up to 1 m. across) consisting of densely interlaced, short, thin twigs with swollen nodes and slender internodes. The leaves are smaller

than in healthy plants, the lamina shows a wavy pattern, and the veins are abnormally prominent especially on the upper surface with profusely developed vein nodes; the petiole and the midrib are flattened, stipules forming at the base of the petiole. On the under side of the leaf, the petiole and ribs as well as the adjoining portions of the blade are slightly lighter in colour with occasional clearing. The shoots arising from stems and stumps are profusely branched and have long, thin internodes and only a few, narrow leaves. The flower buds are abnormally inflated, several buds being frequently set in the axil instead of the normal one. The pistillate floral panicles are elongated and curved, and the flowers deformed, and often partly or completely proliferated. Most of the staminate flower buds proliferate completely or partially, do not form pollen, and die before the spring, the remaining forming short, dwarfed, dark green or red panicles. The fruits are deformed, much enlarged, and parthenocarpic, growing in very compact clusters and producing no seeds. In the extreme stage of infection dark green proliferated panicles appear every year instead of fruits.

The virus was successfully transmitted through the seed and by means of the insect *Liothrips pistaciae*, but not through pollen or juice. Of 200 fruits taken from affected plants, 87 failed to germinate, 92 produced diseased seedlings, and 21 were healthy. Transmission by grafting, particularly by 'oculation' [? budding], was sometimes successful. The ability of the insect to transmit the virus appeared to be confined to one generation. The first symptoms of the disease appeared 21 to 25 days after infection. For control purposes it is recommended that affected branches be removed when the crowns are cleared and trimmed, and that cuttings for grafting and seeds for sowing should be taken only from sound trees.

Peterson (P. D.). **The spore-germination method of evaluating fungicides.**—*Phytopathology*, xxxi, 12, pp. 1108–1116, 1 fig., 1941.

A full description is given of a method for the evaluation of fungicidal efficiency based on that of Montgomery and Moore (*Rep. E. Malling Res. Sta., 1934*, pp. 217–222, 1935), who pipetted measured amounts of test materials on to 15 mm. circles cut into glass slides. In the writer's procedure five 12 mm. glass circles, after washing, sterilization, boiling in distilled water, and drying, are glued, 1 mm. apart, to 75 by 25 mm. slides with petrolatum for the reception of measured quantities of nutrients, toxic solutions, and spore suspensions, pipetted either separately or in combination. Special directions are given for the transference of hanging drops of sulphur fungicides to the circles with a glass rod, 6 by $\frac{3}{16}$ in. With the aid of this method a single slide of the requisite dimensions can be made to carry up to ten different treatments, the fungicidal dosage being accurately controlled and variation in depth and configuration of the drops practically eliminated.

Conidia of *Sclerotinia fructicola* failed to germinate satisfactorily in distilled water when removed from the sporulating surface by means of a needle or brush in such a way as to avoid contamination with nutrients from the culture media. Of the various nutrients tested potato dextrose agar extract proved to exert the maximum stimulus on germination, a high percentage being induced by the extraction of 0·1 gm.

Difco potato dextrose agar powder with 100 ml. water. The writer found that about 20 spores per high-power field of 380 $\mu$ diameter is a desirable maximum for *Sclerotinia* conidia. At this concentration satisfactory germination in the above-mentioned potato dextrose agar extract was obtained in 1 hour.

CUPPLES (H. L.). **Relation between wetting power of a spray and its initial retention by a fruit surface.**—*J. agric. Res.*, lxiii, 11, pp. 681–686, 2 graphs, 1941.

In studying the relation between the wetting power of a spray mixture and its retention on the sprayed surface of fruits, a rotating apple was sprayed with solutions of sodium bicarbonate of known spreading coefficient until it began to run off the surface, and then the volume of the spray solution retained on the apple was determined. Variation in the wetting power of the spray solutions was induced by the addition of varying amounts of a wetting agent and the spreading coefficient determined on mineral oil by the method described by the author in *Industr. Engng Chem.*, xxix, pp. 924–926, 1937. When plotted against each other, the value of the spreading coefficient and that of the relative retention of spray appeared closely related. It is suggested that the spreading coefficient on a reference mineral oil may be used as a practical measure of the wetting properties of aqueous spray solutions.

BELL (H. P.). **The origin and histology of Bordeaux spray russeting on the Apple.**—*Canad. J. Res.*, Sect. C, xix, 12, pp. 493–499, 10 figs., 1941.

When Red McIntosh apple trees growing at Kentville, Nova Scotia, were sprayed with Bordeaux mixture at full bloom in 1939 and 1940, examination of the russeted tissue of the fruit showed the first apparent injury to consist in a browning of the epidermal cells at the base of the hairs. Growth of these discoloured cells became inhibited, and, as a result, cracks developed as the fruit enlarged. Adjacent hypodermal and cortical tissue was exposed and killed. Cork cambiums and cork were formed in the cortex. Further enlargement of the fruit caused the cracks to multiply, extend tangentially, and deepen. All tissues external to the innermost point of fissure penetration were killed. The final scurf-like patches of scar tissue were found to consist of dead epidermis, hypodermis, cortex, cork, and cork cambiums. This scar tissue resulting from induced russeting originated in the hypodermis and was not true cork, which, strictly, is a homogeneous tissue originating in the epidermis. All the sections examined showed that when the injury first appears the cuticle is still intact and without any sign of corrosion. Hence no morphological evidence was forthcoming in support of the view that the spray induced saponification of the cuticle [*R.A.M.*, xviii, p. 466].

**Ministry of Agriculture and Fisheries—Advisory Leaflets Nos. 53, 62, 205, 245, and 248.**—London, H.M. Stationery Office. 1*d* each.

Of these leaflets, all published during 1941, No. 53 deals with tomato wilt or 'sleepy' disease, *Fusarium* [*bulbigenum* var. *lycopersici*] and

*Verticillium* [*albo-atrum*], of which the latter is much the more important in England [*R.A.M.*, xx, pp. 324, 437, 446]; No. 62 with white rot of onion bulbs (*Sclerotium cepivorum*) [ibid., xx, p. 442]; No. 205 with apple mildew (*Podosphaera leucotricha*), particularly troublesome on Lane's Prince Albert and Cox's Orange Pippin in Cambridgeshire and Worcestershire; No. 245 with apple and pear scab (*Venturia inaequalis* and *V. pirina*); and No. 248 with brown rot and allied disease of plum (*Sclerotinia fructigena* and *S. laxa*). All the leaflets are amended, with the exception of No. 245, which is entirely re-written and re-illustrated.

STEVENS (N. E.) & STEVENS (R. B.). **Recent developments in plant diseases in the United States.**—*Bot. Rev.*, vii, 12, pp. 714–736, 5 graphs, 6 maps, 1941.

In continuation of a previous paper by the senior author and Jessie I. Wood [*R.A.M.*, xvi, p. 765], a summary of the available information, largely gleaned from the *Plant Disease Reporter*, is presented concerning a number of plant diseases of special topical interest either by reason of their recent appearance in the United States or of striking fluctuations in extent or severity. Reference has been made in this *Review* from time to time to most of the investigations included in the survey.

HOPKINS (J. C. F.). **A descriptive list of plant diseases in Southern Rhodesia (and their control).**—*Mem. Dep. Agric., S. Rhod.*, 2, 51 pp., 1939.

This list is a revision of the author's earlier list of Rhodesian fungi [*R.A.M.*, xvii, p. 627] incorporating short annotations on the symptoms, occurrence, control, and local distribution of the diseases concerned. The publication is designed to be of use to farmers and gardeners as well as to pathologists.

PARK (M.) & FERNANDO (M.). **Diseases of village crops in Ceylon. Peradeniya Manuals No. IV.**—vi+72 pp., 32 pl. (8 col.), Colombo, Ceylon Govt Press, 1941. Rs. 4.

This manual, compiled at the request of the Minister for Agriculture and Lands, Ceylon, aims at the provision for students of a grounding in the fundamental principles of phytopathology, as well as being a reference book for consultation in the diagnosis and control of the more widespread diseases of crop plants, excluding tea and rubber, already comprehensively treated by T. Petch. With these ends in view the writers have presented the material at their disposal in a semi-popular form, and have drawn extensively on a number of well-known treatises on plant pathology in general and certain tropical crops in particular. Mention should be made of the coloured reproductions executed by the Survey Department.

MATHER (K.). **Heterothally as an outbreeding mechanism in fungi.**—*Nature, Lond.*, cxlix, 3767, pp. 54–56, 1942.

In discussing the problem of heterothally the author examines the breeding system of fungi [*R.A.M.*, xx, p. 588] by the same methods as those used to explain the behaviour of Angiosperms, and arrives at the conclusion that all levels of controlled outbreeding can be traced in

fungi. In the latter, however, the mating behaviour is a property of the haploid phase, while in the former the diploid zygote plays a predominant part.

The genetical mechanism of outbreeding in fungi is described, from the simple case of one set of paired allelomorphs, reducing the possibility of sister-matings to one in two, to the elaborate arrangement of multiple allelomorphic series at several loci, a system which not only decreases still further the possibility of self-mating but also increases the ratio of possible non-sister matings. From the examples supplied it can be seen that the complications of heterothally fit into an ordered scheme when viewed as adaptations to the control of outbreeding. Basically, the function and genetic structure of heterothally are stated to be the same as those of systems found elsewhere, the superficial differences being imposed by peculiar circumstances arising from the existence of an independent haploid phase.

Armstrong (E. F.). **The rot proofing of sandbags.**—*Chem. & Indust.*, lx, 37, pp. 668–674, 2 figs., 1941.

This is a detailed account, based on the work of a Committee of the Research and Experiments Department of the Ministry of Home Security, of the most effective methods for the protective treatment of jute sandbags against deterioration caused by microbiological and other agencies [*R.A.M.*, xxi, p. 89].

Sahni (B.). **Permanent labels for microscope slides.**—*Curr. Sci.*, x, 11, pp. 485–486, 1941.

The writer has successfully prevented the peeling-off of labels on microscope slides apt to occur under tropical conditions of extreme humidity by the application with a brush of two or three coats of a thin paint of cellulose solution in amyl acetate, known commercially as 'duco cement'. The solution dries up almost immediately, forming a transparent film extending beyond the edge of the label and firmly affixing it to the slide.

Conn (H. J.) & Conn (Jean E.). **Value of pigmentation in classifying Actinomycetes. A preliminary note.**—*J. Bact.*, xlii, 6, pp. 791–799, 1941.

The well-founded opinion that the colours produced by species of *Actinomyces*, though striking, are too variable to be successfully used for purposes of classification was fully confirmed by studies at the New York State Agricultural Experiment Station on three unnamed strains isolated from the soil (R1, B2, and B3) and a culture of *A. coelicolor* (formerly designed *A. violaceus-ruber*) supplied by Waksman from New Jersey. The organisms were grown on a synthetic medium containing varying amounts of glucose (0·1 to 5 per cent.). In all the strains pigment (as distinct from colour) production was fairly constant, the variability in colour being attributed to the fact that the pigments act as hydrogen-ion indicators [*R.A.M.*, xiii, p. 259], so that the appearance of a given culture may differ greatly according to whether the pigment is present in its alkaline or acid phase, or partly in each form.

It is evident from these and other data accumulated in previous

studies (*J. Bact.*, xxxix, p. 21; xl, p. 168, 1940) that these pigments differ from one another, but at the same time they share a few characteristics, all being more soluble in alkaline than in neutral solutions, their acid phases almost insoluble in water, and their alkaline phases deeper in tone than their acid ones. Presumably the pigments are acid dyes with insoluble colour acids, but highly soluble sodium salts; their exact chemical nature, however, has not been determined.

SNYDER (W. C.) & HANSEN (H. N.). **The effect of light on taxonomic characters in Fusarium.**—*Mycologia*, xxxiii, 6, pp. 580–591, 2 figs., 1941.

When strains of *Fusarium solani*, *F. solani* f. *cucurbitae*, *F. oxysporum* f. *niveum*, and *F. avenaceum* were grown in culture in daylight, the light being excluded from duplicate series, the colours displayed by the fungi fell into three groups on the basis of their relation to light. The flesh-ochre and cinnamon-pink pigments displayed by *F. oxysporum* f. *niveum* occurred only in the presence of light. The ramier-blue shown by the same fungus developed both in light and darkness. The dusky green-blue of *F. solani* from tomato also developed in light and darkness, but was less obvious in the absence of light, and it was associated with conidial masses, the production of which was much reduced in conditions of darkness. A third type of pigmentation was noted in one strain of *F. solani* f. *cucurbitae* and one of *F. solani*, in which the vetiver-green, dark hyssop-violet, and citron-yellow hues developed much more conspicuously in darkness than in light.

Cultures in the dark consistently showed greater mycelial growth than those kept in the light. All cultures exposed to the light showed zonation in some degree, though this feature was not present in those grown in the dark.

The sporodochial strain of *F. oxysporum* f. *niveum* produced sporodochia copiously in light, but not in darkness. In the pionnotal strain of the same fungus, pionnotes developed much more abundantly in light than in darkness. *F. solani* and its f. *cucurbitae* respectively produced sporodochia moderately and abundantly in light, but only sparsely in darkness. In *F. avenaceum* sporulation was plentiful along the edges of the colony in contact with the glass in light, but not in darkness.

Perithecial primordia of *Hypomyces solani* developed copiously in light, but not at all in darkness after two weeks' growth. After one month both the cultures grown in light and those grown in darkness were fertilized with conidia from the opposite sex strain. Two weeks later perithecia were abundantly present on the cultures in light, and practically absent in the others. The development of the primordia into mature perithecia was favoured by continued exposure to light.

Spores of all strains produced in light were consistently larger, and invariably had more septa, than those that developed in the dark. Evidence was obtained that the effect of light was produced on that portion of the thallus that was in active growth at the time of exposure. Single-spore cultures subjected to light for the first four days of growth only, showed less development than others allowed to remain in light.

The authors conclude that in the case of *Fusarium* species and

similar fungi, such characters as colour, zonation, colony type, presence or absence of sporodochia, size, shape, and septation of macroconidia, and even the occurrence of a perithecial stage, cannot successfully be employed in taxonomy [*R.A.M.*, xix, p. 495] unless the fungi are grown in the presence of adequate light.

DUTCHER (J. D.). **The chemical nature of gliotoxin: a microbicidal compound produced by the fungus Gliocladium fimbriatum.**—Abs. in *J. Bact.*, xlii, 6, pp. 815–816, 1941.

Investigations at the Squibb Institute for Medical Research, New Brunswick, New Jersey, on gliocladin, the crystalline isolate from *Gliocladium fimbriatum* possessing marked fungicidal activity [*R.A.M.*, xxi, p. 155], showed it to be also both bacteriostatic and bactericidal towards both Gram-negative and Gram-positive bacteria, completely inhibiting the growth of *Staphylococcus albus*, for instance, at the rate of 2·5 mg. per ml., and that of *S. aureus* and *Streptococcus viridans* at 1 mg., while 10 mg. sufficed to check the development of all the Gram-negative organisms tested. Gliotoxin is toxic to higher animals at doses of 50 to 75 mg. per kg. body weight. The formula for gliotoxin was found to be $C_{13}H_{14}O_4N_2S_2$, and its molecular structure is described.

HOPKINS (J. C. F.). **Diseases of fruit, flowers, and vegetables in Southern Rhodesia. 5. Diseases of Potatoes.**—*Rhod. agric. J.*, xxxviii, 12, pp. 672–690, 11 figs., 1941.

Useful notes are given in popular terms on the symptoms and control of potato diseases in Southern Rhodesia, as well as on the conditions predisposing the plants to attack.

EDDINS (A. H.). **Brown rot of Solanaceous plants. Soil treatment for control of brown rot of Potatoes.**—*Pr. Bulls Fla agric. Exp. Sta.* 548 (revised), 4 pp.; 553, 2 pp., 1940.

In the first of these two bulletins a popular résumé is given of the available information on brown rot of potatoes and other Solanaceae (*Bacterium solanacearum*), already presented at greater length in a previous publication of the Florida Agricultural Experiment Station [*R.A.M.*, xvi, p. 271]. The pathogen in question is of greater economic importance in the State than all other potato diseases combined. Entire [chilli] pepper plantings may be destroyed by rotation with severely affected potatoes, while in some ten-acre eggplant fields losses of between 50 and 60 per cent. of the plants have been reported.

In the second bulletin full directions are given for the control of *Bact. solanacearum* in sandy soils by the application of commercial flowers of sulphur [ibid., xviii, p. 473] from May to July in quantities sufficient to adjust the existing reaction to $P_H$ 4 or below, in practice representing a range from 300 lb. per acre at $P_H$ 4·4 to 1,300 at $P_H$ 6·4. In the following October and November the soil reaction should be readjusted to $P_H$ 5·2 for potatoes, and 5·5 to 6 for tomatoes, eggplants, and chillies, by the application of calcium limestone at 2,000 to 5,000 lb. per acre. During the period intervening between the two treatments a crop of cowpeas or *Crotalaria* should be grown on the sulphured soil. In the Hastings area, where the soil reactions on most farms range from

$P_H$ 4·8 to 5·2, the cost of the fertilizers should not exceed $20 per acre. In 1935, a season conducive to infection by *Bact. solanacearum*, the yields of marketable eggplants and tomatoes on severely infested land treated the year before exceeded by 10 and 15 times, respectively, those from untreated control plots.

WHEELER (H. E.) & LUTMAN (B. F.). **Staining scab Actinomyces in aerial Potato parts.**—*Stain Tech.*, xvii, 1, p. 41, 1942.

The method recently described by Hutchins and Lutman for staining the mycelium of *Actinomyces* [*scabies*] in potato roots and tubers [*R.A.M.*, xxi, p. 156] required certain modifications for successful application to the aerial parts of the plants, in which the hyphae are very much finer than in the underground system. For instance, the duration of washing in absolute alcohol had to be reduced, in the case of stem sections, from 30 or 60 minutes to a few seconds in order to obviate complete decolorization, the best results being obtained by simply flooding the slide once or twice and then transferring it to xylol for 24 hours. The coagulation of freshly made crystal violet solutions into a sort of aniline oil emulsion on the slides may be avoided by allowing the solutions to stand for 48 hours, then filtering and repeating the process.

MÜLLER (K. O.) & ORTH (H.). **Über einen Spätpflanzversuch mit Kartoffeln.** [On a late planting experiment with Potatoes.]—*Ernähr. Pfl.*, xxxvii, 4–5, pp. 37–40, 1941.

A description is given of a series of preliminary experiments conducted on the premises of the German Potash Syndicate, Berlin-Lichterfelde, in 1940, to determine the adaptability of the BRA 5/31 potato variety for late planting (six to eight weeks beyond the normal date) in succession to winter catch crops. This variety was selected as possessing certain characteristics essential for the purpose in view, including resistance to biotype A of *Phytophthora infestans* [*R.A.M.*, xix, p. 490 and next abstract] and (in comparison with the majority of potatoes at present on the market) also to degeneration. In these tests on a light sandy soil the desirable qualities of BRA 5/31 were fully maintained. Attention has already been drawn by Alten and Ortb to the inhibitory action of arginin on sporangial germination in *P. infestans* [ibid., xx, p. 273], and in this connexion an analysis was made of the arginin content of BRA 5/31 leaves and tubers in comparison with those of four other varieties, viz., Ackersegen, Frühmolle, Parnassia, and Böhms Mittelfrühe. The tubers in particular of BRA 5/31 were found much richer in arginin than those of the other four varieties, those from the plot receiving a complete fertilizer (with potash in the form of potassium chloride), for instance, containing 0·36 per cent. on a dry weight basis, compared with 0·081, 0·16, 0·13, and 0·16 per cent., respectively, in Ackersegen, Frühmolle, Parnassia, and Böhms Mittelfrühe.

HAGENGUTH (K.) & GRIESINGER (R.). **Untersuchungen über den Stickstoffhaushalt der Kartoffelknolle bei der Phytophthora-Fäule.** [Studies on the nitrogen metabolism of the Potato tuber in *Phytophthora* rot.]—*Phytopath. Z.*, xiii, 5, pp. 517–529, 1941.

The comparative chemical analysis of healthy Jubel potato tuber

tissue and of similar material permeated by *Phytophthora infestans* (biotype A), to which this variety is susceptible, revealed a uniformly higher (average 2 per cent.) water content in the latter, accompanied by a substantial decline (21 per cent.) in non-albuminous nitrogen and a corresponding increase in albuminous, principally protein, nitrogen. These metabolic changes were most pronounced in the upper layers of the tuber halves, i.e., those nearest the site of infection. On the other hand, in the case of the resistant BRA 5/31 variety, on which the pathogen made virtually no growth [see preceding abstract] there was no perceptible decrease of non-albuminous nitrogen (0·7 per cent.). The results indicate that *P. infestans* does not utilize the albumin in the tuber for its growth but assimilates the non-albuminous nitrogen, consisting principally of amino acids. No definite conclusions as regards the relationship between a low non-albuminous nitrogen content and enhanced resistance to late blight and vice versa could be reached on the basis of analyses of the selfed progeny of the resistant variety.

David (Elisabeth) & Störmer (Inge). **Capsicum annuum als Testpflanze für einige Kartoffelviren.** [*Capsicum annuum* as an indicator plant for certain Potato viruses.]—*Phytopath. Z.*, xiii, 5, pp. 532–538, 3 figs., 1941.

Viruses are stated to be among the most harmful pathogens of potatoes at the headquarters of the Pomeranian Seed Selection Association at Dramburg [*R.A.M.*, xviii, p. 133], where the heaviest reductions in yield are caused by streak (Y virus) [ibid., xv, p. 391] and leaf roll. In the Erdgold variety, for instance, the yield from a Y-diseased crop of four years' standing was 19·8 kg. per 100 plants as compared with 104·7 from the same number of healthy ones; a leaf-roll crop of Stärkereiche [Starchy] after four years produced 30·4 kg. per 100 plants, as against 99·2 from the same number of sound ones, the corresponding figures for Fram being 31·1 and 80·4, respectively. On the other hand, the losses caused by mixtures of X+A and X+Y are considerably smaller, Erdgold affected by the former (expressed as severe mosaic), for instance, yielding 84 kg. per 100 plants as compared with 104·7 from the healthy control as mentioned above.

Since the losses from virus infections tend to become progressively heavier, plant-breeders are obviously concerned to propagate exclusively from virus-free strains, and for this purpose inoculations with the proposed selections must be made on an indicator plant. Chilli (*Capsicum annuum*) presents various practical advantages for the end in view, and served as an excellent indicator of the presence of the X virus, with or without admixtures of A and Y, even in infinitesimal amounts, so that, in addition to eye cuttings, the young sprouts and the tuber may be used as sources of inoculum. It is not, however, altogether reliable as a test plant for the Y virus, and the outcome of inoculations with A was negative, these results being in contradiction to those obtained by [I. C.] Kovačevski in Bulgaria (in litt.). The use of Samson tobacco as a test plant for A or Y is therefore required if it is desired to ascertain whether these viruses are absent [cf. ibid., xviii, p. 472].

Attempts to transmit the X and Y viruses from diseased chilli plants to their progeny by way of the seed were unsuccessful.

Ellenby (C.). **Trace-elements and 'Potato-sickness'.**—*Nature, Lond.*, cxlix, 3767, p. 50, 1 graph, 1942.

The results of a small-scale field experiment carried out during 1941 showed that the mean height of potato plants grown in soil infested with the eelworm *Heterodera schachtii* (which is considered not to be the sole cause of the disease known as 'potato sickness'), was considerably higher in the series watered with dilute solutions each containing minute amounts of a salt of one of various trace elements, than in the untreated series, the differences being most marked where the most dilute solutions were used. Thus, although the total quantity of zinc supplied to each plant treated with zinc sulphate throughout the season amounted to only 0·05 mg., the mean height of plants watered with the most dilute zinc sulphate solution was 40 per cent. greater than that of untreated plants. Similar effects were observed in the case of boric acid (total quantity supplied 0·5 mg.) and, to a lesser degree, in that of manganese chloride. Parts of the plot receiving the stronger solutions of trace elements exhibited generally a considerably greater mean height of plants, but the percentage differences between treated and untreated rows were not so large. It is considered probable that, under the conditions of this experiment, the treatments spread to the adjacent untreated rows and that that tendency was greater the stronger the solution used.

McKay (R.) & Clinch (Phyllis). **Freezing injury to Potato tubers.**—*J. Dep. Agric. Éire*, xxxviii, 2, pp. 367–373, 5 figs., 1941.

Unusually severe cold during the winters of 1938 to 1940 is stated to have caused considerable injury to potatoes in Eire, both in storage and transit. The following types of injury were observed in potatoes stored for experimental purposes at Glasnevin. Soft tubers with either total or partial softening of tissue exuding a sticky liquid when pressed and having blackened eyes and lenticels encircled by black areas represent the extreme form of injury and the affected tubers are completely killed. Firm tubers may have either (1) internal necrosis nearly always associated with the vascular tissue; (2) 'mealiness' followed by the collapse of dead cells, localized in any part of the tuber but most frequently in and within the region of the vascular ring; (3) killed eyes accompanied usually, but not always, by some visible internal injury; or (4) sunken areas usually about ½ in. in diameter.

In small-scale laboratory experiments with potato varieties Kerr's Pink, Up-to-Date, and Early Rose, a striking difference was observed in the resistance of individual tubers to low temperatures, but not of varieties. Exposure to 17° F. for 4 and 6 hours resulted in the milder types of injury, and for 18 hours in the most severe (soft tubers), while tubers exposed to 17° for 2 hours or to from 28° to 30° for 18 and 72 hours remained uninjured. When planted out, the affected tubers, according to the severity of the injury, may either soon become decayed by organisms of all kinds, fail to sprout if the eyes are dead, or fail to survive owing to weak sprouting. It is concluded, therefore, that frozen consignments should not be used for seed purposes. When freezing is suspected, sample tubers should be cut across at the heel and examined for internal symptoms. During prolonged cold spells in

winter pitted potatoes can be adequately protected by increasing the depth of the covering soil and by lining the latter with straw; in the case of potatoes stored in sheds, a lamp should be used to keep up the temperature to 30°.

PFÄLTZER (A.). **Vlugschrift der Centrale Proefstations-Vereeniging No. 1. Meeldauwbestrijding door zwavelbestuivingen.** [Leaflet No. 1 of the Central Experiment Stations Association. Mildew control by sulphur dusting.]—*Bergcultures*, xv, 44, pp. 1491–1492, 1941.

The following are the chief points to be borne in mind in the sulphur dust treatment of rubber mildew [*Oidium heveae*] in the Dutch East Indies [*R.A.M.*, xvii, p. 553]. A plantation covering some 600 ha. can be treated by means of a motor-duster, using either sulphur sludge or cirrus sulphur, the former a hygroscopic product containing 65 per cent. sulphur, which should be strewn out in a thin layer to dry, put through a sieve, and mixed with freshly slaked lime (one part to nine of the sludge) before use. Dusting is best carried out between 7 a.m. and 11 a.m., the first application being made when 20 per cent. of the trees in a group of 125 to 150 show fresh leaves or unfolding buds, and repeated every seven to eight days (one or two after heavy showers of rain) until 90 per cent. of the trees have put out new, stiff foliage. For each of the first three or four treatments 3 kg. cirrus or 4 kg. sludge per ha. should be used, the corresponding quantities for subsequent applications being 4 and 5 kg., respectively. Dusting should not be carried out in windy or wet weather. In very rainy districts the necessary repetition of the treatment every three or four days adds to the cost, and even then success is not assured; it is doubtful whether dusting can be regarded as profitable under such conditions. In nurseries dusting should be begun very early in the refoliation period and at least twice the ordinary number of applications are essential.

KANIVETZ (I. I.) & KHARITON (E. G.). Приготовление препарата гриба **(Trichoderma lignorum)** в целях заражения почвы. [Preparing soil inoculum of the fungus *Trichoderma lignorum*.]—*Научн. Зап. по Сахарн. Пром.* [*Sci. Notes Sug. Ind.*], *Kieff*, [Grey Ser.], xvi, 2–3, pp. 104–108, 1939.

On the basis of four years' study on the beneficial effect of *Trichoderma lignorum* [*T. viride*: *R.A.M.*, xx, p. 508] on the yield of sugar beet, the following practical method is proposed for the incorporation of the organism into the soil. Dry cake from the extracting press is scalded with boiling water, then cooled down to between 35° to 40° C. and inoculated with pure cultures of *T. viride* on 2 per cent. beet agar, diluted at the rate of 15 to 20 gm. culture to 2 l. water. It is estimated that 15 to 20 or, where available, even 40 kg. press cake can be applied to a 1 ha. field, 100 to 150 c.c. of the diluted pure culture being needed for the inoculation of 600 gm. dry press cake. The inoculated press cake, carefully covered with sterilized paper, is kept for four to six days at a temperature of 25° to 27°, till the surface of the mass is covered with dark green mats of spores. It is then thoroughly mixed with either sterilized peat or black soil to give a mixture for use at the rate of 2 to 3 z. [100 to 150 kg.] per ha. The mixture is either broadcast or placed

in rows on the soil or on the manure spread over the soil, and ploughed under the same day or early next day.

Positive results were obtained in laboratory tests when seeds of oats or winter wheat were inoculated with water suspensions of press cake containing *T. viride* (15 to 20 gm. pure culture per l. water per ha.), prepared immediately before inoculation, which can be carried out simultaneously with vernalization, or before sowing. Laboratory tests (and in the case of formalin field trials also) showed that *T. viride* survives treatment with various seed disinfectants such as preparation AB, Davidoff's, and formalin.

In the case of winter crops the mixture containing the organism should be incorporated at a depth of 5 to 6 cm. in rows between the rows of seeds.

PEELE (T. C.) & BEALE (O. W.). **Influence of microbial activity upon aggregation and erodibility of lateritic soils.**—*Proc. Soil Sci. Soc. Amer.*, v, pp. 33–35, 1940. [Abs. in *Chem. Abstr.*, xxxv, 20, p. 7089, 1941.]

*Penicillium oxalicum* and *Fusarium moniliforme* [*Gibberella fujikuroi*] were shown to promote the aggregation of Cecil clay loam soils under aseptic conditions. The inoculation of non-sterile soil after additions of sucrose or ground oats straw resulted in more extensive aggregation than in the uninoculated controls, while similar treatments in field plots decreased run-off and erosion and increased granulation.

MILLER (J. H.), GROGAN (R. G.), & BOWDEN (R. A.). **Diseases of medicinal herbs at the College of Agriculture, Athens, Georgia.**—*Plant Dis. Reptr*, xxv, 17, pp. 441–443, 1941. [Mimeographed.]

Plantings of medicinal herbs covering a total area of 24 acres were made at the College of Agriculture, Athens, Georgia, in 1941 to replace the European importations cut off by the war. The most important pathogen was *Bacterium solanacearum*, persisting in the soil of plots formerly occupied by its various hosts, including tomato and groundnut. The belladonna (*Atropa belladonna*) and henbane (*Hyoscyamus niger*) plantings were completely destroyed by the bacterial wilt, which also caused a minimum loss of 40 per cent. in an irrigated plot of Jimson weed (*Datura stramonium*), the same host in a drier situation being little affected by *Bact. solanacearum* but suffering almost complete defoliation by *Alternaria crassa* [*R.A.M.*, xiii, p. 597]. *Sclerotium rolfsii* was responsible for severe damage to *Carduus benedictus*, 30 per cent. of the plants wilting on an irrigated plot. *Rhizoctonia* [*Corticium*] *solani* caused 30 per cent. damping-off among dill (*Anethum graveolens*) and fennel (*Foeniculum vulgare*) seedlings in the greenhouse, while wilt (*Fusarium* sp.) attacked 10 per cent. of almost fully grown catnip plants (*Nepeta cataria*) and an unidentified crown rot killed 50 per cent. of the anise (*Pimpinella anisum*) stand.

MACMILLAN (H. G.). **Some diseases of drug plants and herbs observed in southern California.**—*Plant Dis. Reptr*, xxv, 17, pp. 443–445, 1941. [Mimeographed.]

Belladonna (*Atropa belladonna*), one of the drug plants grown on a

small scale in southern California in 1941 [cf. preceding and next abstracts], was attacked by *Rhizoctonia* (?) *solani* [*Corticium solani*], *Thielavia* [*Thielaviopsis*] *basicola* [*R.A.M.*, i, p. 103], *Peronospora hyoscyami* [ibid., xvi, p. 65], and *Fusarium* sp., the two former causing damping-off and the two latter downy mildew and root rot, respectively. In the case of the last-named, bacteria were uniformly present in the externally sound tissues ahead of the fungal mycelium and were probably in part responsible for the decay. A species of *Fusarium* also caused complete disorganization of foxglove (*Digitalis purpurea*) roots, accompanied by gradual wilting and death of the plants.

MIDDLETON (J. T.). **Some diseases of Belladonna in California and their control.**—*Plant Dis. Reptr*, xxv, 20, pp. 513–514, 1941. [Mimeographed.]

Belladonna (*Atropa belladonna*) roots, crowns, and stems in hillside plantings on heavy, poorly drained soils in California are infected by *Phytophthora parasitica*, the pathogenicity of which was established by inoculation experiments. The affected roots turn dark brown to black and become water-soaked and flaccid. Infection progresses upwards, often reaching the crown and stem. Diseased stems bear conspicuous, dark, slightly sunken areas, and under conditions of moderate to high temperatures and high relative humidity the basal leaves may also be attacked. The incidence of infection, which is liable to spread through an entire planting, may be considerably reduced by the discontinuance of overhead irrigation and the application of 2–2–50 Bordeaux mixture with a suitable wetter. Soil sterilization with chloropicrin has given excellent control of damping-off by *Pythium ultimum*, *P. de Baryanum*, and *P. irregulare*. The threatened destruction of the plantings by downy mildew (*Peronospora hyoscyami*) [see preceding abstract] was averted by thorough treatment with 0·5 per cent. lime-sulphur and 0·05 per cent. B. 1956 emulsifier, the results obtained with 2–2–50 Bordeaux and emulsifier being less satisfactory. Foliar diseases of no economic importance were caused by a species of *Alternaria* resembling *A. solani* and species of *Ramularia* and *Mycosphaerella*.

McMARTIN (A.). **Red rot in Co. 290 Cane.**—*S. Afr. Sug. J.*, xxv, 11, pp. 587, 589, 591, 3 figs., 1941.

In this paper, preceded by an introductory note by H. H. Dodds, Director of the South African Sugar Experiment Station, the writer reports the discovery on the Co. 290 sugar-cane variety in the Eshowe district of Natal of red rot (*Colletotrichum falcatum*), not hitherto recorded in South Africa, though believed to have long been present in the country in a relatively mild form on Uba. P.O.J. 2725, though not yet actually found infected, is also suspected of harbouring the fungus. Pending the development of resistant varieties (probably including Co. 281 and 301), growers are advised to restrict the spread of infection by the exclusive use of sound material for seed; the ploughing-out of badly diseased stands, which should be followed by a long fallow, with a green manure crop in the interval; and the burning of infected cane before cutting for the mill.

Snyder (W. C.) & Hansen (H. N.). **The species concept in Fusarium with reference to section Martiella.**—*Amer. J. Bot.*, xxviii, 9, pp. 738–742, 1941.

After expressing the view that the distinctions made by Wollenweber and Reinking for the separation of *Fusarium* species and varieties are too closely drawn to be of practical use, the authors adduce experimental data to demonstrate that the present system fails to provide a serviceable classification and nomenclature, particularly with reference to section *Martiella*.

All available members of the section were assembled, including the fungus described by Harter in 1938 as the cause of a pea root rot under the name *F. coeruleum* [*R.A.M.*, xvii, p. 787], Goss's *F. solani* var. *eumartii*, as well as the *F. solani* reported by him in 1940 as the cause of a potato stem rot [ibid., xix, p. 359], *F. solani*, *F. solani* var. *martii*, and its f. 1, *F. solani* var. *minus*, *F. solani* var. *striatum*, *F. javanicum*, and *F. aduncisporum*, made available by Wollenweber. In addition, the writers possessed a large assortment of isolates of most members of the section, representing widely separated geographical areas. The only one not studied was *F. javanicum* var. *ensiforme*.

Twenty single-spore cultures of each of nearly 100 isolates were made on potato dextrose agar and grown under identical conditions. Similar numbers of single spore cultures were made from these in turn. All culture transfers were made by means of single spores, and observations were made on numerous series of these cultures for nearly two years.

It early became apparent that macroscopic characters such as nature of aerial mycelium, kind and degree of pigmentation of spore masses, mycelium, or substrate, presence or absence of sclerotia or conidial fruiting structures, and colony configuration and growth rate, were entirely unreliable criteria for separation of the members of the section. Thus, certain Californian isolates of the following fungi, compared in pure culture under identical conditions, showed the same type of colony growth and dark blue pigmentation, and appeared (at sight) to be the same fungus: *F. solani*, saprophyte, from tomato, *F. solani* var. *martii* f. 2, parasite, from pea, *F. javanicum*, parasite, from vegetable marrow, and *F. coeruleum*, wound parasite, from a potato tuber. The fungus described by Harter in 1938 as a new root rot pathogen of pea, under the name *F. coeruleum*, was indistinguishable in appearance from the culture of *F. solani* var. *martii* (App. et Wr.) Wr. f. 2 Sny. listed above, and is probably a natural variant of it. Other isolates or variants of these same fungi had cream to light green spore masses and white mycelium, making it difficult, if not impossible, to distinguish them at sight from each other or from *F. solani* var. *eumartii* (Carp.) Wr., *F. solani* near *martii* f. 3 Sny., or from the *F. solani* described by Goss as the cause of a potato stem rot.

When hundreds of single ascospore cultures were made from perithecia of *Hypomyces ipomoeae* from squash, developed in pure culture by mixing single conidium cultures of field isolates, a striking array of cultural types was obtained. The range in pigmentation and in colony appearance shown by this single fungus was wider than the range of

cultural types exhibited by the combined collection of all other members of section *Martiella*, including those described by Wollenweber and Reinking.

Evidence of variability in measurements is cited from papers by a number of workers. Thus, Snyder (1934) has shown [ibid., xiv, p. 334] that average measurements of 3-septate conidia from the sporodochia produced in successive transfers of a single culture of *F. solani* var. *martii* f. 2 may be $30 \times 3 \cdot 9$, $35 \cdot 8 \times 4 \cdot 7$, or $44 \cdot 4 \times 5\ \mu$. Measurements of conidia from this fungus described by F. R. Jones under the name *F. martii* var. *pisi* [ibid., iv, p. 456] were given as 27 to 40 by 4 to $4 \cdot 5\ \mu$. The difference in average lengths reported by Snyder may, therefore, be $14\ \mu$, a difference greatly exceeding those now used to separate species. Even the average measurements of 3-septate conidia of a single spore culture of the same fungus, grown at the same time on different media varied (Snyder, 1934) from 35·8 by 4·7 to 41·2 by 4·7, a difference approximating to that between *F. coeruleum*, *F. solani*, and *F. javanicum*. Harter (1939, 1941) observed that *F. solani* var. *martii* f. 2, at one time may have abundant 3-septate but no 5-septate conidia, and at another time 14 per cent. of 5-septate conidia [ibid., xx, p. 597].

In a large single ascospore series from the squash isolate of *H. ipomoeae* wide differences were observed in the quantity of macroconidia produced, in size of conidia, in frequency of septation, and in spore shape. Chlamydospores and microconidia were produced in varying quantities by all cultures. Further, the range shown by these variations in microscopic, morphologic characters within this one fungus extended approximately across the range of characters used to distinguish the species and varieties of the section.

The authors propose to combine all the fungi in section *Martiella*, including the ascigerous forms, into a single species, the conidial stage of which is referred to *Fusarium solani* (Mart.) App. et Wr. emend., on the basis of morphologic characters. Five parasites of this section are classified as *formae* of the species, on the basis of pathogenicity alone, viz., *F. solani* f. *cucurbitae* n.f., *F. solani* f. *eumartii* (Carp.) n. comb., *F. solani* f. *phaseoli* (Burk.) n. comb., *F. solani* f. *pisi* (Jones) n. comb., and *F. solani* f. *radicicola* (Wr.) n. comb.

The two species, three varieties, and one form of the perfect representatives of this section are placed in the one species. The perfect stage of the fungus is *Hypomyces solani* Reinke & Berthold, which is emended to embrace all variants of the fungus hitherto given specific or varietal rank, namely *H. haematococcus* and its vars. *breviconus*, *caneri*, and *H. ipomoeae*, its f. 1 Wr., and its var. *major*. One form of this species, H. *solani* f. *cucurbitae* n.f. is erected for the ascigerous stage of the biologically specialized *F. solani* f. *cucurbitae*.

A synonymy is given relating the revised nomenclature to that of Wollenweber and Reinking.

PETRAK (F.). **Mykologische Notizen. XIII.** [Mycological notes. XIII.] —*Ann. mycol., Berl.*, xxxviii, 2–4, pp. 181–267, 1940.

In this further series of critical annotations of fungi (851–930) [cf. *R.A.M.*, xiv, p. 124] the following are among the items presented. *Thyrospora* Kirschst. is relegated to synonymy with *Pleospora* [ibid.,

xvii, p. 841; cf. xx, p. 307]. *Encoelia kirschsteiniana* (Jaap) Kirschst. is regarded, on the basis of comparative spore measurements, as a synonym of *Phacidiella discolor* [ibid., xvi, p. 690]. It is apparent from the same author's description of *Phaeosphaerella berolinensis* on *Sorbus* [*Pyrus*] *aucuparia* that the fungus in question is none other than *Spilosticta inaequalis* (Cke) Petr. (syn. *Sphaerella inaequalis* Cke, *Venturia inaequalis* Wint. emend. Aderh.). Kirschstein's differentiation of *Spilosticta* from *Mycosphaerella* is also based on a misconception as regards the importance of setae. Actually these organs are neither numerous nor persistent in the former genus, and may indeed be altogether absent. The genus *Endostigme* Syd. is inseparable from *Spilosticta*. Similarly, *Phaeosphaerella macularis* (Fr.) Trav., which has not hitherto been recognized as a *Spilosticta* owing to the habitual absence of setae from the perithecial ostioles, must be transferred to this genus as *S. macularis* (Fr.) Petr. There is considered to be no doubt that this species is the ascigerous stage of *Fusicladium radiosum*, i.e., a form of *V. tremulae* [ibid., xix, p. 387] devoid of setae. The fungus known as *Phyllosticta viticola* [ibid., ix, p. 12] is shown by a critical examination to be a typical *Phyllostictina*, which should be designated *P. viticola* (Berk. & Curt.) Petr., with the following synonymy: *Septoria viticola* [loc. cit.], *Sacidium viticolum*, *Phyllosticta labruscae*, *P. vulpinae*, and *P. ampelopsidis*. *Rhopographus chorinensis* Kirschst. (*Ann. mycol., Berl.*, xxxvii, p. 117, 1939) is evidently identical with *Leptosphaeria coniothyrium*.

JENKINS (ANNA E.) & BITANCOURT (A. A.). **Revised descriptions of the genera Elsinoë and Sphaceloma.**—*Mycologia*, xxxiii, 3, pp. 338–340, 1941.

Revised descriptions, in English, are given of *Elsinoe* and its conidial stage *Sphaceloma*, pending the publication by the authors of a monograph on the two genera.

BITANCOURT (A. A.) & JENKINS (ANNA E.). **Treze novas espécies de 'Elsinoe' do Brasil.** [Thirteen new species of *Elsinoe* from Brazil.] —*Arq. Inst. biol. S. Paulo*, xii, 1, pp. 1–20, 17, pl. (1 col.), 1941. [English summary.]

Included in this critically annotated list, accompanied by technical descriptions, of 13 new species of *Elsinoe* collected in Brazil from 1936 to 1939 is *E. lepagei*, which forms on the leaves of *Achras sapota* irregular, raised, verruciform, rugose, well-defined, purplish-grey lesions, 0·5 to 2 mm. in diameter, and on the shoots numerous small, oval, slightly raised, rugose spots, 0·5 to 1 mm. in diameter. The fungus is characterized by fuscous, erumpent perithecia, 45 to 80 $\mu$ in diameter, round when viewed from above, pulvinate to hemispherical in transverse section; globose to obpiriform, biseriate asci, 16 to 22 by 12 to 21 $\mu$; and hyaline, triseptate ascospores, slightly constricted at the median septum, 10 to 16 by 4 to 7 $\mu$. On potato dextrose agar it produces compact, convoluted, cinnamon-buff colonies covered with white 'down' and surrounded by a viscous marginal zone.

VIENNOT-BOURGIN (G.) & SACCAS (A.). **Morphose cladosporioide chez Fusicladium pirinum.** [Cladosporioid morphosis in *Fusicladium pirinum*.]—*C.R. Acad. Sci., Paris*, ccxiii, 20, pp. 701–704, 1941.

Living tissues of pear, apple, and peach infected, respectively, by *Fusicladium pirinum* [*Venturia pirina*], *F. dendriticum* [*V. inaequalis*], and *Cladosporium carpophilum*, were maintained in a saturated atmosphere at 12° to 20° C. for 36 hours. The conidia of *V. inaequalis* were formed singly on each conidiophore, and were already germinating. The conidia of the other two species tended to form in short chains of two or three and the shape of each varied according to its position in the chain. This character is held by the authors to link the typical species of *Fusicladium* and *Cladosporium*.

PETRAK (F.). **Beiträge zur Pilzflora der Umgebung von Wien.** [Contributions to the mycoflora of the environs of Vienna.]—*Ann. mycol., Berl.*, xxxviii, 2–4, pp. 339–386, 1940.

Included in this critically annotated list of fungi collected by the author in the environs of Vienna during 1939 is *Microthyriella rubi* [*R.A.M.*, xix, p. 291], observed on dry raspberry canes.

GODOY (E. F.) & DELLE COSTE (A.). **El 'mildew' del Tabaco en la región tabacalera de Salta.** [Tobacco 'mildew' in the Salta Tobacco-growing region.]—*Rev. argent. Agron.*, vii, 3, pp. 221–227, 4 figs., 1940. [English summary.]

In the spring of 1939 an epidemic of tobacco downy mildew, involving the Virginia, Burley, and Criollo varieties, occurred in the provinces of Salta and Jujuy, Argentina, where heavy losses were sustained in the seed-beds, many in fact being totally destroyed. The causal organism was tentatively attributed by J. C. Lindquist to *Peronospora nicotianae* [*R.A.M.*, xvi, p. 65], which differs from *P. tabacina*, the agent of a similar disease in Australia, the United States, and Brazil, in its more slender conidiophores (260 to 400 $\mu$ in length, mean 350 $\mu$) and smaller conidia (15 to 24·5 by 12 to 16, mean 21 by 14·5 $\mu$). The fungus, which was last observed in the Argentine by Spegazzini in 1902 on *Nicotiana alpina*, produced on the leaves yellow to chestnut-coloured lesions with irregular margins, spreading from the tip downwards, tending to converge and assuming a bluish cast on the under side, where the fructifications develop in profusion; at 15 to 20 days old the seedlings present a scorched aspect and collapse.

THUNG (T. H.). **Waarnemingen over resistentie-eigenschappen bij verschillende Tabakssoorten.** [Observations on resistance properties of various Tobacco varieties.]—*Landbouw*, xvi, pp. 646–652, 1940.

In experiments at the Java Phytopathological Institute to determine the reactions to *Phytophthora* [*parasitica* var. *nicotianae*] of a number of selected tobacco varieties [*R.A.M.*, xvii, p. 490] two methods were adopted, one involving the cultivation of seedlings in trays filled with contaminated soil, and the other the inoculation of the leaves of mature plants by two hours' exposure to a constant stream of an aqueous suspension of infested soil. Tested by both methods, Hickory Pryor and

Joyner were the most resistant of the Virginia selections, while among other types Timor was much more susceptible than Djepoen; of the Rembang strains, Nos. 58 and 78 (Bkl 1 and Br 1) were the most resistant in trays and No. 80 (Br 3) in the leaf test, indicating variations between the reactions of the root and foliar systems. A number of crosses have been made in the hope of developing a new cigarette tobacco combining resistance to *P. parasitica* var. *nicotianae* with vigorous growth and other desirable characters.

The average percentages (by field counts) of slime disease [*Bacterium solanacearum*] among the Virginia, Rembang, and miscellaneous groups were 62, 35, and 38 per cent., respectively, the most susceptible in each being Gold Dollar (No. 41), Pr 1 (No. 88), and Koegopo A and B (No. 172), respectively, and the most resistant Cash (No. 40), Semboeng Cantjoer (No. 162), and Kastoeri (No. 176), respectively.

Clayton (E. E.) & McKinney (H. H.). **Resistance to the common mosaic disease of Tobacco.**—*Phytopathology*, xxxi, 12, pp. 1140–1142, 1 fig., 1941.

In 1939 and 1940 field tests were conducted at the Bureau of Plant Industry, Washington, D.C., to determine the relative merits of the so-called Ambalema and *Nicotiana glutinosa* types of resistance to tobacco mosaic [*R.A.M.*, xvii, p. 629; xviii, p. 62]. Genotypes with the *glutinosa* resistance, when inoculated with the mosaic virus, rapidly developed profuse systemic necrosis, and many of the plants were killed [cf. ibid., xxi, p. 51]. Such genotypes would logically be regarded as much more susceptible than ordinary tobacco, especially at the high temperatures prevailing during the summer in the major tobacco-growing areas of the United States. Many of the *glutinosa*-tobacco hybrids, moreover, succumb at a lower temperature, and over a wider age range, than the *glutinosa* parent. The widespread impression that the *glutinosa* reaction in tobacco is confined to the local lesion type of symptoms may be attributed to the performance of much of the breeding work under fairly cool greenhouse conditions. In contrast to the Ambalema type of resistance, established by six years of rigorous field trials, the prospects for the further development of *glutinosa* are not considered to be promising. Even more resistant than Ambalema is T.I. 448, one of the many collections with a similar type of reaction to the virus from Colombia [ibid., xviii, p. 629].

Holmes (F. O.). **A distinctive strain of Tobacco-mosaic virus from Plantago.**—*Phytopathology*, xxxi, 12, pp. 1089–1098, 2 figs., 1941.

Plants of rib grass (*Plantago lanceolata*) and broad-leaved plantain (*P. major*), growing as weeds near Princeton, New Jersey, were observed in the autumn of 1940 to show slight torsion of the petioles, chlorotic streaks along the veins, and systemic chlorotic mottling. A filterable virus was isolated from both hosts and inoculated into Turkish tobacco and *Nicotiana glutinosa*, on which necrotic lesions were formed, resembling those of tobacco ring spot on the former host and tobacco mosaic on the latter. The effects of the strains being apparently identical, that from rib grass was used in all further experiments. On *N. sylvestris* it induced the formation of dark brown, necrotic local lesions of the type

associated with the aucuba types of the tobacco mosaic virus. Tomato reacted to infection either by the development of inconspicuous localized lesions or occasionally by a spotty, chlorotic mottling. The rib grass strain of the virus formed only primary, mostly chlorotic lesions on *Physalis angulata*. Both bean (*Phaseolus vulgaris*) and cucumber were immune from infection.

Evidence that the rib grass virus is a strain of tobacco mosaic is afforded by its resistance to ten minutes' heating at 92° C. and to 122 days' desiccation at 23°, its infectiousness (tested on *N. glutinosa* leaves) at high dilutions ($10^{0}$ to $10^{-6}$), its precipitation by the tobacco mosaic virus antiserum, its failure to produce typical necrotic primary lesions in tobacco and *N. sylvestris* tissues previously invaded by the tobacco mosaic virus proper, and its response to the genic constitution of tobacco. Differences from the type include adaptation to rib grass, the tendency to induce necrotic-ring effects in tobacco (the most important character), and inability to attack the bean. The new strain is designated *Marmor tabaci* var. *plantaginis* n. var.

Takahashi (W. N.). **Changes in nitrogen and virus content of detached Tobacco leaves in darkness.**—*Phytopathology*, xxxi, 12, pp. 1117–1122, 1942.

During dark culture at the University of California the tendency of proteins to undergo hydrolysis in detached leaves of mosaic tobacco plants (i.e., those inoculated four weeks previously) and mosaic-inoculated foliage (inoculated immediately after detachment) did not differ from that of the proteins in healthy leaves. The virus multiplies in mature detached tobacco leaves [*R.A.M.*, vii, p. 409] stored in the dark with their petioles in distilled water, so that the process does not seem to demand meristematic cells or actively growing tissue, and is further compatible with a scarcity of proteins resultant on hydrolysis. Under the experimental conditions the living tobacco cell is incapable of utilizing tobacco mosaic virus protein in support of its respiration, being apparently devoid of any mechanism for the hydrolysis of this extraneous substance. The extract from trypsin-treated macerated infected tissues was more virulent in tests on *Nicotiana glutinosa* leaves than that from untreated tissues, probably owing to the disaggregation of the virus in the former material. The crystalline inclusion bodies in mosaic leaves do not function as reserve protein, nor are they drawn upon by the starving host tissues for assistance in respiration. Stream double refraction [ibid., xii, p. 525] is not destroyed in detached tobacco leaves by prolonged culture in the dark.

Woods (M. W.) & Du Buy (H. G.). **Synthesis of Tobacco mosaic protein in relation to leaf chromoprotein and cell metabolism.**—*Phytopathology*, xxxi, 11, pp. 978–990, 1 fig., 1 diag., 1 graph, 1941.

The results of the investigation on tobacco mosaic virus protein in Turkish tobacco plants make clear that the synthesis of the virus protein is very like that of chromoprotein ('chlorophyll protein') and possibly from the same building units. The two processes are dependent on one respiratory enzyme system which is in its turn dependent on the nitrate nitrogen supply. This gives an explanation of the stopping of

virus multiplication when the nitrogen supply is low [*R.A.M.*, xx, p. 499]. The suggestion is made that the tobacco mosaic virus is an abnormal chondriosomal or chromoprotein material or has a relation to such substances.

MILLER (G. L.) & STANLEY (W. M.). **Derivatives of Tobacco mosaic virus. I. Acetyl and phenylureido virus.**—*J. biol. Chem.*, cxli, 3, pp. 905–920, 2 graphs, 1941.

Ultracentrifuge and electrophoretic measurements of acetyl and phenylureido derivatives of the tobacco mosaic virus indicated a homogeneity comparable to that of the unaltered virus. Determinations of specific virus activity, using the half-leaf method, on *Nicotiana glutinosa* and beans (*Phaseolus vulgaris*) showed that some 70 per cent. of the amino and 20 to 40 per cent., possibly more, of the phenol plus indole groups of the virus could be covered with either the acetyl or phenylureido groups without significant loss of activity, and it is inferred from the fact that normal virus was formed in Turkish tobacco plants inoculated with samples of the derivatives that these proportions of the amino and phenol group in the tobacco mosaic virus molecule are not concerned to any extent with the basic processes of virus reproduction.

BREMER (H.). **Das Blattrollen der Tomaten.** [The leaf roll of Tomatoes.] —*Phytopath. Z.*, xiii, 5, pp. 445–480, 15 figs., 1941.

A detailed, fully tabulated account is given of the writer's observations and experiments at the Biological Institute, Berlin-Dahlem, from 1929 to 1935, on tomato leaf roll [*R.A.M.*, v, p. 60], three forms of which are differentiated, viz., basal, total, and apical. In basal leaf roll the foliage is thick, brittle, and as it were 'stiffened', incapable of reverting to the normal expanded habit even under appropriate environmental conditions; in the total form of the disorder all leaves of the plant are affected as in the foregoing, except that young leaves in the upper part of the plant remain soft and pliable, while apical rolling is not accompanied by any other symptoms. The basal form is always irreversible and the total usually so, while in the apical form the foliage undergoes no fundamental structural alteration and may recover. The cause of basal leaf roll is an abnormal accumulation of organic matter in the leaves due to the cutting down of plants to the ordinary complement of one to three shoots. The development of the trouble may thus be obviated by the omission of cutting, while the removal of flowers or fruits intensifies the symptoms. Basal leaf roll is little, if at all, affected by rainfall or watering, but it is increased by strong illumination and reduced by shade. Total leaf roll is an advanced form of basal leaf roll. Apical leaf roll is the response of the plants to a shortage of water.

Tomato varieties fall into three groups in respect of their reaction to leaf roll, namely, non-rolling, medium-rolling, and rolling, the first being a heterogeneous collection, mostly of coarse- and broad-leaved, xeromorphous habit, in which a drooping of the pinnae towards the leaf axis takes the place of rolling; the second, comprising the best known heavy yielders, are mesomorphous types responding to cutting by basal leaf roll; while the third category is represented by plants of a

hygromorphous habit, giving poor yields under dry conditions, with thin, pointed leaves, markedly precocious, and tending to total rolling even without the stimulus of cutting. Representatives of the non-rolling group include Immune, Best of All, Stone, and Tuckswood, of the medium-rolling Augusta and Lucullus, and of the rolling President Garfield, Queen of the Earlies, and Beauty of Lorraine.

Other members of the Solanaceae suffering from leaf roll (besides potato) in Germany include *Solanum nigrum*, *S. pruniforme*, and *Lycopersicum humboldtii*.

WILSON (J. D.). **Disease control method for canning Tomatoes.**—*Canning Age*, xxiii, 1, pp. 47–49, 2 figs., 1942.

This is a summary of the writer's recommendations (noticed in part from other sources) for the control of tomato diseases, including early blight [*Alternaria solani*] and leaf spot (*Septoria*) [*lycopersici*] in northern Ohio [*R.A.M.*, xx, p. 181]. Three- to seven-row spraying or dusting machines have been found more practical than larger ones for the treatment of 3- to 10-acre fields. If the rows are planted 4½ to 5 ft. apart, the boom width should be adjusted to 22 to 25 ft., the upper limit for satisfactory performance and ease of handling. The critical period for infection by the above-mentioned fungi extends locally from 25th June to 1st September, during which time four or five applications of a copper-containing preparation should be given, the first between 25th June and 5th July and the rest at 12-day intervals. Dusting, though slightly less efficient in disease control than spraying, can be so much more conveniently and cheaply carried out that it is likely to come into general use. A standard spray formula may be stated as 4–4–100 (copper compound at 50 per cent. metallic plus flour and water), and that for a dust as 13–13–74 (copper, bentonite, and diluent), the liquid being applied at the rate of 100 to 250 gals. and the dry material at that of 25 to 40 lb. per acre.

SHAPOVALOV (M.). **Curly top control methods.** *Ex* **Solving Utah canning crop problems. Proceedings of the Fifth Annual School for Canning Crop Growers and Canners' Fieldmen, Ogden, Utah, 1941.**—[*Publ.*] *Utah agric. Coll. Ext. Serv.*, N.S., 109, pp. 24–25, 1941.

DORST (H. E.). **Reducing curly-top disease losses.**—loc. cit., pp. 25–26, 1941.

BLOOD (H. L.). **The curly-top breeding program.**— loc. cit., pp. 26–29, 1941.

In the first of these papers a full account is given of investigations on the relation of certain cultural practices, including modified spacing, to the incidence of tomato curly top in Utah, a note on which has already appeared [*R.A.M.*, xxi, p. 103 and next abstracts].

In the second paper the author states that the first migration of *Eutettix tenellus*, the vector of curly top, into the tomato-growing districts of northern Utah in 1940 occurred in late April and early May, and involved large numbers of leafhoppers from the southern part of the State and northern Arizona, which conveyed the virus to sugar beet and early-planted tomatoes, killing some 10 per cent. of the latter.

The second influx, consisting of leafhoppers from neighbouring breeding grounds in the north, took place between 20th May and 15th June, and resulted in the transmission of the virus to mid-season and late tomatoes, causing 75 per cent. of the total seasonal loss in these crops. The first symptoms of infection in early plantings appeared about three weeks after the entry of the insects into the fields, while the peak of the loss from the second influx was reached in 30 to 35 days. Some 35 per cent. of the exposed tomato plants under observation were killed by curly top in 1940, compared with only 2 per cent. in 1939. The incidence of infection was reduced in experiments during 1939 and 1940 by from 55 to 85 per cent. by protecting the plants with cheesecloth covers from the time of setting out until mid-June, while a substantial decline in mortality was also obtained by a double-hill planting system, in which a plant is set at each of two corners of the hole when the soil is broken by the shovel, the distance between the two plants being about 6 in. In a heavily infested area in 1940 the average percentage of survival at the end of the season ranged from 76 to 87·7 in double-hill plots, as against 24·9 to 29·2 in those with only one plant per hill, the cost of the additional plants being offset by the increased yield.

The third paper gives a tabulated account of nine years' breeding experiments undertaken with a view to the development of resistance to curly top in tomatoes. Definite limitations to the success of the project through repeated selection among strains of *Lycopersicum esculentum*, wild or commercial, were indicated, while *L. pimpinellifolium* also gave disappointing results in the 1940 tests. On the other hand, 21 accessions of *L. peruvianum* and its varieties showed an average of only 16·31 per cent. infection, and one of *L. glandulosum* 12·8 per cent. in the same series of trials. Some of these accessions appear to be altogether immune from infection with 30 viruliferous insects at Logan, Utah.

WHIPPLE (O. C.). **Injury to Tomatoes by lightning.**—*Phytopathology*, xxxi, 11, pp. 1017–1022, 3 figs., 1941.

Lightning injury to field tomatoes is stated to be a frequent concomitant of electrical storms in south-eastern Wisconsin and northern Illinois, and among its symptoms (exclusive of complete prostration) are collapse of the stem and drooping of the tops; more or less extensive hollowing of the stem pith; collapse and desiccation of individual leaves of plants near the periphery of the striking area of the lightning; small longitudinal or circular stem lesions; irregular burnt areas on the stems, leaves, and fruits; and blistering of the fruit surface and partial or complete 'cooking' of the underlying tissue.

**Dutch Elm disease in 1941.**—*Plant Dis. Reptr*, xxv, 17, pp. 450–451, 1 map, 1941. [Mimeographed.]

A map, compiled from the weekly reports of the Bureau of Entomology and Plant Quarantine from 8th September, 1940, to 13th September, 1941, shows the spread of Dutch elm disease (*Ceratostomella ulmi*) [*R.A.M.*, xxi, p. 104] in that period. New locations include Alford in Massachusetts (first report for the State), Preston in

Connecticut, Kiefer in Maryland, and Fort Ashby in West Virginia, and eight counties adjacent to the main infection area.

WEBER (G. F.). **Leaf blister of Oaks.**—*Pr. Bull. Fla agric. Exp. Sta.* 558, 2 pp., 1941.

*Taphrina coerulescens* produces on the new foliage of various species of oaks [*R.A.M.*, viii, p. 405] in Florida small, circular (up to $\frac{1}{16}$ in. in diameter) or irregular ($\frac{1}{4}$ to $\frac{1}{2}$ in.) blisters of variable colour, predominantly blended shades of green, yellow, rose, and purple, the spores developing on the concave side of which impart, first a silver-grey sheen, and later a brownish, velvety appearance, to the surface. Large blisters, or those situated on the main veins, are apt to induce foliar curling and distortion of the narrow-leaved varieties. The exact mode of perpetuation of the fungus is not known, but infection is largely confined to the leaves developing in the early spring from the dormant buds and to those next produced on the new shoots. Direct control measures, as distinct from general sanitary precautions, are applicable only to small trees of particular value: fallen leaves should be removed from the vicinity and a standard fungicide, e.g., 4–4–50 Bordeaux mixture, sprayed over the buds a week or ten days before they begin to swell, followed if necessary by a second treatment before the full expansion of the foliage.

YATSENKO-KHMÉLÉVSKY (A. A.) & VASSILEVSKA (LYDIE M.). **La réaction des cellules vivantes du bois de Hêtre abattu à la propagation du champignon.** [The reaction of the living cells of felled Beech wood to fungal propagation.]—*C. R. Acad. Sci. U.R.S.S.*, N.S., xxvi, 7, pp. 709–712, 1940.

In comparative experiments freshly cut beech blocks and similar blocks, killed with formaldehyde or alcohol and thoroughly washed, were placed on cultures of *Fomes igniarius* and incubated for 10 to 90 days in one test and for 20 to 120 days in another. Microchemical determinations were made (in both tests) of starch, sugar, and tannic materials; sections were stained with safranin and methylene blue, and the hyphae with aniline blue dissolved in lactic acid.

The data obtained showed that the presence of the fungus in the wood induced changes in the state of the plastic materials different from those observed in the wood after felling. In the killed wood infected by the fungus all the plastic materials gradually disappeared. The tannic materials and starch disappeared first, probably becoming changed into sugar, which itself became less in quantity towards the end of the experiment. The disappearance of starch and tannic substances coincided with the appearance of the first signs of the destruction of the cell walls. In some of the vessels in heavily infected wood the hyphae and their products were visible macroscopically as brownish spots and lines.

The introduction of the fungus into the untreated living wood in ten days changed all the plastic materials into a brownish liquid filling the whole cavity of the living cell and then accumulating in the cavities of the fibres and vessels. The infiltration of this liquid (provisionally referred to as 'mycoinfiltrate') into the walls imparted the brown colour to the living infected wood. The formation of the mycoinfiltrate

is considered to have resulted from the reaction of the living cells to the fungus. This substance was not observed in dead wood. Tyloses were formed only in infected wood and never in the sterile controls.

These results demonstrate that it is possible to distinguish infected wood from wood showing a traumatic reaction, and to determine, even in the absence of tyloses, from the state of the plastic substances whether infection has occurred in the living or dead wood.

THIRUMALACHAR (M. J.). **Hapalophragmium ponderosum Syd. on Acacia leucophlaea Willd.**—*J. Indian bot. Soc.*, xx, 5–6, pp. 293–298, 1 pl., 4 figs., 1941.

The rust *Hapalophragmium ponderosum*, which has been observed to form on the branches, flowers, and pods of *Acacia leucophlaea* in the Bangalore district of India tumours closely resembling in anatomy and mode of development those of crown gall (*Bacterium tumefaciens*), is characterized by stipitate, tricellular, reddish-brown, persistent teleutospores giving rise without a resting period to oval, binucleate sporidia, 10 by 8 $\mu$, germinating *in situ*. Hyaline or deep brown, oval, ostiolate, subepidermal pycnidia, containing masses of oval or spherical spores embedded in nectar, were detected for the first time both on young galls and on fresh excrescences from old ones. Hyperplasia, tumour strands, tracheids, and fusiform parenchymatous cells are among the features common to both the rust and bacterial galls under comparison. *A. leucophlaea* has further been recently observed to harbour another species of *Hapalographium*, *H. tandonii* Mitter.

OLSON (A. J.). **A root disease of Jeffrey and Ponderosa Pine reproduction.**—*Phytopathology*, xxxi, 12, pp. 1063–1077, 3 figs., 1941.

From 1937 to 1940 the writer made observations and experiments on a disease causing an exudation of yellowish-white 'pitch' on the surface of the roots and root-collars of pines (*Pinus jeffreyi* and *P. ponderosa*) on the eastern slope of the Sierra Nevada, northern California. No external symptoms are shown in the early stages of infection, but as the malady progresses the normal colour of the needles fades to a paler, and ultimately to a whitish green. With the death of the trees the needles turn yellow, later brown, and are finally shed. The steles of affected roots are heavily infiltrated with 'pitch', some of the small roots becoming translucent because of the infiltration. The affected trees were consistently found in the vicinity of old stumps, from which infection evidently radiated by way of the roots. The age of the trees observed by the writer ranged from 5 to 17 years, but in 1934 Salman and Wright noticed cases of the disease in much older ones, measuring 14 to 16 in. in diameter at breast height. Little economic importance attaches to the disorder at the present time.

The fungus originally isolated by Wright and later by the author from infected material is named *Cunninghamella meineckella* n. sp., and is characterized by sparsely septate, ivory-coloured, later fuscous hyphae, 2·1 to 5·7 (mean 3·6) $\mu$ in diameter; erect simple, septate conidiophores, 57·5 to 402·5 by 4·8 to 7·9 (250 by 6) $\mu$, with round heads, 9·3 to 21·2 (16·5) $\mu$ in diameter, and sterigmata 2·3 to 4·6 (2·5) $\mu$ in length; and hyaline, smooth-walled, obovate conidia, 4·5 to 7·2 by 5·3

to 11·1 (5·6 to 8) $\mu$. The minimum, optimum, and maximum temperatures for the growth of the organism on potato dextrose agar were found to be 0·1°, 22° to 25°, and between 33·2° and 36·8° C. Inoculation experiments gave 100 per cent. successful results on the roots of 2½-year-old seedlings and on those of saplings in the woods; 1½-year-old seedlings developed the typical symptoms in two cases out of 20, but those up to one year old reacted negatively to the pathogen. Inoculations made by placing portions of roots on which *C. meineckella* had been cultured, in close contact with, but not fastened to, a healthy uninjured root of Jeffrey pines 4 to 10 ft. high, gave uniformly positive results, proving that the disease can be spread by root contact.

Day (W. R.). **Forest pathology.**—*Rep. Imp. For. Inst., Oxford, 1940–41*, pp. 11–13, 1941.

In this report [cf. *R.A.M.*, xix, p. 505] it is stated that in the areas surveyed by Oxford University working parties in connexion with emergency war felling of timber, butt rot was observed to be a commoner source of loss among conifers, particularly larch and spruce, than has hitherto been realized. Apparently, a tendency to develop extreme moisture conditions is correlated with a prevalence of butt rot, but the course of the events which accompany death and infection of the roots is not known. The chief agent of decay is *Fomes annosus* [cf. ibid., xviii, p. 827], with *Polyporus schweinitzii* [ibid., xx, pp. 328, 435] next in importance. There was some indication that the fungus concerned is able to attack the root and kill it only in certain limited soil layers. Acute lime-induced chlorosis was observed in Japanese and hybrid larch; the more severely affected trees were found on sites that allowed only shallow root penetration, owing to the presence of a bed of re-cemented chalk rubble in the subsoil. Chlorotic European larches reacted to injection tests.

Further observations on European larch die-back [ibid., xix, p. 179] indicated that it occurs at high elevations (in relation to the surrounding topography), in situations where severe frosts are experienced, in exposed places (especially those looking east), in ravines, and in certain soil profile types (e.g., a fairly shallow, freely draining loam over excessively drained fissured hard rock); nutrient deficiencies may, possibly, conduce to susceptibility, and seed provenance is unquestionably important, though seed unsuccessful in one locality may prove successful elsewhere.

Owing to the cool, wet summer, elm disease [*Ceratostomella ulmi*: ibid., xix, p. 172] was less prevalent and milder in 1941 than in 1940.

Andrews (S. R.) & Gill (L. S.). **Western red rot control for the Black Hills.**—*J. For.*, xxxix, 10, pp. 818–823, 2 figs., 1 graph, 1941.

The outcome of a survey involving the examination of all dead branches pruned from 1,582 pine (*Pinus ponderosa*) trees on 26 plots in the Black Hills of South Dakota for the presence of western red rot (*Polyporus ellisianus*) [*R.A.M.*, xix, p. 310] (the examination being restricted to branches below 17 ft.) indicated that the incidence of infection in first logs is concentrated in the so-called large-branched trees having one or more dead branches with a basal diameter exceeding 1·5 in. below a height of 17 ft. In thinned stands infection increased

from 5 per cent. in the 41 to 60 year to 10 per cent. in the 61 to 80 year age class, while the average incidence of the rot in 81- to 120-year-old unthinned stands was 27 per cent., denoting a rapid increase above the age of 80. The maximum infection observed to originate below a height of 17 ft. under natural conditions was about 33 per cent. Generally speaking, the incidence of infection increased directly with d.b.h. In thinned stands the amount of decay in the 8 to 9 in. d.b.h. trees was about four times that occurring in the 4 to 5 in. class. In the same stands 22 and 31 per cent. of the trees with large dead branches were infected in the 41- to 60- and 61- to 80-year age classes, respectively, compared with only 4 and 7 per cent., respectively, of those with small dead ones.

Where stand improvement operations are under consideration, a considerable reduction in the eventual loss from decay may be effected in stands up to 80 years where the predominating diameters exceed 6 in. by pruning only small-branched trees as crop trees. Thinning in dense young stands tends to increase the average branch size and thereby to promote the likelihood of western red rot infection. No heart rot was found in dissected trees under 80 years old, whereas 33 per cent. of those about 140 showed an average of 7 linear ft. of decay in the butt log.

Rabanus (A.). **The laboratory testing of wood preservatives. The behavior of wood treated with copper sulfate.**—*Holz Roh- u. Werkstoff*, iii, pp. 233–238, 1940. [German. Abs. in *Chem. Abstr.*, xxxv, 5, p. 1596, 1941.]

In wood treated with water by the Boucherie process [*R.A.M.*, xx, p. 506], the loss of weight in test blocks due to controlled decay is about the same as in the untreated check samples, showing that the influence of nutrient materials in the sap is negligible. The amount of copper sulphate required to protect wood against different fungi varies greatly. Leaching tests support the claim frequently advanced that some of the copper is fixed in the wood, and the formation in the latter of copper carbonate is assumed. In culture media malachite and cuprous oxide are equally toxic with copper sulphate to five wood-destroying fungi, but much less so to seven others. Small test blocks, treated first with copper sulphate and then after drying, with sodium carbonate, resisted the attacks of three fungi, but succumbed to those of another three. The copper is leached more rapidly from poles set in soils containing an abundance of decaying nitrogenous matter, but otherwise the nature of the soil is of slight importance, the inconsistency of the results of copper sulphate impregnation being due to the distribution of the various fungi concerned in the rotting of the wood.

Gewecke (H.). **Absorption of (wood-) treating solutions and completeness of treatment in sap-displacement processes with modern salt mixtures.**—*Holz Roh- u. Werkstoff*, iii, pp. 321–325, 1940. [German. Abs. in *Chem. Abstr.*, xxxv, 5, p. 1597, 1941.]

In the treatment of telephone poles with arsenate-chromate-fluoride salts [cf. *R.A.M.*, xxi, p. 107] by the Boucherie process [see preceding abstract], the amount of chemical introduced is 10 to 15 times that required to inhibit decay. A simple method of estimating the probable response to treatment of any wood by means of small test pieces is described.

Cohen (S. I.) & Heald (F. D.). **A wilt and foot rot of Asparagus caused by Fusarium oxysporum Schlecht.**—*Plant Dis. Reptr*, xxv, 20, pp. 503–509, 1941. [Mimeographed.]

*Fusarium oxysporum* was isolated from the tissues of asparagus in many of the irrigated sandy soils of Washington, where the crop has recently been observed to suffer from a wilt and foot rot believed to be identical with the disease reported by M. T. Cook from New Jersey in 1923 under the name of 'dwarf' [*R.A.M.*, iii, p. 73]. The trouble appears to be widespread in the United States, being more destructive than rust [*Puccinia asparagi*] in New York and Massachusetts, where 5 to 10 per cent. of the stands are commonly affected. In the lower Yakima Valley, Washington, the incidence of crown infection ranges from 25 to 50 per cent. The symptoms include a red or reddish-brown discoloration of the tissues, sometimes extending 2 ft. upwards into the stem, depressions and cracks in the stem bases, a yellow streaking of the shoots, a red discoloration of the shell, desiccation of the roots, and complete cortical disintegration by secondary invaders. One symptom of infection is represented by a sudden wilting of the young shoots before cladophyll production, while yet another aspect is revealed by the inspection of young plantings, in which the shoots are frequently girdled at soil-level by elliptical red-brown lesions, the fungus being present in the red-streaked tissues of the white outer stems.

All the symptoms detected on asparagus in nature were induced in greenhouse inoculation experiments at 20° to 29° C., the incubation period being shorter in sandy than in silt loam soils. High temperatures likewise favour the development of the pathogen, which penetrates uninjured tissues as easily as wounded ones. The underground rootstock of asparagus differentiates root and stem meristems at its apices. As the current year's organs die, the fungus penetrates them and lives saprophytically during the winter and spring, but vigorously attacks the living portions of the host in the warm summer periods. Isolates of the fungus from supposedly healthy five-year-old crowns from South Carolina and California also caused typical infection. The asparagus strain of *F. oxysporum* differs from others already described in its failure to attack potatoes, tomatoes, and carnations at 20° to 22°, and potato tubers and onion bulbs at 25°. All commercial varieties of asparagus appear to be equally susceptible, the ornamental *Asparagus plumosus* is subject to infection in the greenhouse, and the fungus further causes a slight wilt of Alaska peas of which the symptoms resemble 'near wilt' [*F. oxysporum* f. 8: ibid., xviii, p. 777]. Two cases of seedling wilt caused by the fungus were reported from widely different regions. Infected root stems and crowns showed the presence of hyphae of the fungus in the tracheae, xylem parenchyma, phloem, and cortical parenchyma. Necrosis [cf. ibid., ii, p. 521; xiv, p. 323] of the parenchyma cells far in advance of the hyphae indicated the presence of a toxic secretion by the fungus.

Experimental treatments with various fertilizers did not appreciably mitigate the severity of the disease, the sole practicable measure for the control of which probably lies in the development of a hybridization programme initiated from naturally resistant species or strains of asparagus.

Mouravieff (V. P.). Пероноспороз Свеклы. [Peronosporosis of Beet.] —*Научн. зап. по Сахарн. Пром.* [*Sci. Notes Sug. Ind.*], *Kieff*, [Grey Ser.], xvi, 2–3, pp. 62–75, 6 figs., 1939.

The distribution and intensity of *Peronospora schachtii* [*R.A.M.*, xx, p. 333] infection on sugar beet, which until recently was of rare occurrence in the Soviet Union, is stated to have strikingly increased during 1937–8. The disease spread to several districts on the right and left banks of the river Dnieper, affecting up to 7 per cent. of plants in some fields. The late summer (August–September) sowings proved to be the most susceptible to infection, which is easily explained by the fact that the development of the seedlings from these sowings takes place mainly in cool and moist weather, most favourable for the development of the fungus. It is stated that as yet no satisfactory method exists for the treatment of mother roots before transplanting or for diagnosing the presence of disease in them. For the control of the disease all diseased roots should be destroyed at lifting, and all diseased plants detected at periodical inspections of the growing crop removed and the surrounding soil sprayed with 1 per cent. Bordeaux mixture over a radius of 15 to 20 m.

Tolman (B.) & Stoker (G. L.). **Sulfur and nitrogen deficiency relationships in Sugar Beets grown for seed in Oregon.**—*J. Amer. Soc. Agron.*, xxxiii, 12, pp. 1072–1079, 4 figs., 1941.

Both nitrogen and sulphur deficiencies were conspicuously in evidence on sugar beets grown for seed in the Willamette Valley, Oregon, in 1939, the former manifested by retarded, spindly growth, chlorosis, and a reduction in the number of plants entering into seed production, and the latter by similar abnormalities of growth and colour with the addition of breakdown of the foliar tissue, increased susceptibility to infection by *Ramularia beticola* [*R.A.M.*, xxi, p. 121], and the development of a vegetative condition of the seed heads in place of normal flowering. Sulphur and nitrogen interacted strongly both on plant development and seed production, the former exerting no effect on yield in the absence of the latter, while the response to nitrogen was much more apparent in the presence of sulphur. Applications of both elements will obviously be necessary in commercial sugar beet production in the region under observation, probably in excess of 125 lb. per acre in the case of nitrogen, to judge from the outcome of preliminary tests.

Weber (G. F.). **Bacterial spot of Peppers.**—*Pr. Bull. Fla agric. Exp. Sta.*, 549, 2 pp., 1940.

A popular note is given on bacterial spot of chilli (*Phytomonas vesicatorium*) [*Xanthomonas vesicatoria*] in Florida, where heavy losses, especially on the sweet or mild varieties [*R.A.M.*, xix, p. 451], have been caused by the disease on several occasions since its first detection in the State in 1916. Control measures should include judicious crop rotation, excluding from the immediate sequence tomatoes, the only other local host of the pathogen; disinfection by immersion for five to seven minutes in 1 in 1,000 mercuric chloride or a normal solution of organic mercury, or by dusting with mercury or red copper oxide; the

application to the soil of the seed-bed, as the seedlings are emerging, of a normal organic mercury solution sufficient to wet the ground for a depth of ½ in.; the spraying of the whole bed, when the seedlings have put out two or three leaves, with 1–2–50 Bordeaux mixture or red copper oxide, or dusting with copper-lime; and the weekly treatment of infected plants in the field with 4–4–50 Bordeaux mixture.

WEBER (G. F.). **Cowpea scab.**—*Pr. Bull. Fla agric. Exp. Sta.* 557, 2 pp., 1941.

Cowpea scab (*Cladosporium vignae*) [*R.A.M.*, x, p. 82] has been found to be more severe in Florida on spring than on summer or autumn plantings. The symptoms of the disease and the life-history of the pathogen are described [ibid., v, p. 76]. The fungus survives from the harvest to the next season's planting time on the seed coat or in the cotyledons. Primary infection resulting from this source is seldom very conspicuous unless a high percentage of the seed contracts the disease and weather conditions favour its development. The foliar and young stem lesions may also be easily overlooked, so that secondary infection is liable to develop before flowering. A diagnosis of scab may be based on curved or coiled pods bearing large, slightly raised, cracked, brown to tan, corky lesions, with irregular margins.

In addition to the use of healthy seed (which cannot be guaranteed until certified material is placed on the market) and a definite scheme of rotation, control measures should include the application, at ten-day intervals from the seedling stage to flowering, of 2–2–50 Bordeaux mixture or 20–80 copper-lime dust at the rate of 10 to 25 lb. per acre for each treatment. In recent experiments on the reaction to *C. vignae* of 30 cowpea varieties, the otherwise desirable fresh-vegetable types, such as Ramshorn, California, Extra Early, and strains of Blackeye, proved highly susceptible and produced few or no marketable pods or seeds. The early varieties, e.g., Blue Goose, Black Crowder, Purple Hull, and Purple Hull Crowder, remained free from infection during the season, as also did the mid-season and late Brabham, Clay, Cream Crowder, Iron, Lady Finger, and Whippoorwill, the latter group, however, setting a light crop of pods; Bunch Conch and Cream Lady were usually attacked.

ZAUMEYER (W. J.). **Reaction of Pea varieties to Septoria pisi.**—*Phytopathology*, xxxii, 1, pp. 64–70, 1942.

Of the 134 pea varieties and strains inoculated with *Septoria pisi* [*R.A.M.*, xix, p. 601; xx, pp. 211, 450] in the field in Colorado from 1936 to 1939, only two exhibited a very high degree of tolerance in respect of the leaf spot, viz., one strain of Perfection and an unnamed import from Puerto Rico. Of the canning varieties, 20 were moderately, 22 severely, and 7 mildly infected, the last-named being mostly of the Perfection type, with disease indices ranging from $1{\cdot}1 \pm 0{\cdot}18$ to $2{\cdot}2 \pm 0{\cdot}36$ (1 to 2, 2 to 3, 3 to 4, and 4 to 4+ representing mild, moderate, severe, and very severe infection, respectively), while Canners Delight ($1{\cdot}4 \pm 0{\cdot}19$), Rogers Delicious ($1{\cdot}6 \pm 0{\cdot}19$) and Rogers Famous ($1{\cdot}9 \pm 0{\cdot}19$) were also fairly resistant. Only Rogers No. 95 of the market-

garden varieties showed mild infection (1·9±0·19). None of the edible podded varieties was highly tolerant, but only one, Mammoth Pod Early, was extremely susceptible (4·2±0·27). Besides the above-mentioned Puerto Rican strain (1·1±0·19), two other field varieties, Black Eye Marrowfat and Blue Prussian, showed only mild infection (1·6±0·36 and 1·8±0·43, respectively).

Costa (A. S.) & De Souza (O. F.). **Nota sôbre a verrugose do Amendoinzeiro.** [Note on Groundnut scab.]—*Biológico*, vii, 12, pp. 347–349, 2 figs., 1941.

During the season of 1938–9 groundnut scab (*Sphaceloma arachidis*) occurred in a severe form at the Central Experiment Station of the Agronomic Institute, Campinas, São Paulo, Brazil [*R.A.M.*, xx, p. 427], subsequent attacks in the next two years being of a milder character. The incidence of infection on 38 varieties (designated by numbers only) in the first year of observation ranged from nil in No. 44 (possibly a species of *Arachis* distinct from *A. hypogaea*) to 4·1 (5 representing extensive foliar spotting) in No. 45, satisfactory resistance being shown by Nos. 2, 4, 9, 15, and 31, with ratings of 0·8, 0·4, 0·6, 0·8, and 0·6, respectively.

Retter (G. R.). **The cultivation of Mushrooms.**—*J. N.Y. bot. Gdn*, xliii, 505, pp. 8–14, 6 figs., 1942.

The writer gives an outline of the principles underlying the successful cultivation of mushrooms (*Psalliota campestris*) in the United States, where the annual output is stated to exceed 40,000,000 lb., and of the methods of application to be adopted, but for fuller information intending growers are referred to the 'Manual of Mushroom Culture' of the Chester County Mushroom Laboratories or to *Bull. U.S. Dep. Agric.* 1875 [*R.A.M.*, xx, p. 621].

Jenkins (W. A.). **Angular leaf spot of Muscadines, caused by Mycosphaerella angulata n.sp.** — *Phytopathology*, xxxii, 1, pp. 71–80, 2 figs., 1942.

Attention has already been drawn to a muscadine grape (*Vitis rotundifolia*) disease in Georgia caused by a fungus previously known as *Cercospora brachypus* [*R.A.M.*, xxi, p. 64] but herein designated by a name appropriate to the newly discovered perfect stage, viz., *Mycosphaerella angulata* n.sp. This phase of the fungus may be observed on recently fallen leaves, maturing throughout the period from October to the end of February, and consists of amphigenous, ovate to subglobose, semi-immersed, black perithecia, beaked before maturity, later provided with a papillate ostiole, 40 to 90 by 40 to 60 $\mu$; and cylindrical-clavate, short-stipitate, fasciculate, aparaphysate, bitunicate asci, 36·4 to 42 by 8·4 to 14 $\mu$, each containing one to two rows (the second imperfect) of bicellular, straight or slightly curved, hyaline, guttulate spores, 14 to 19·6 by 2·8 to 5·6 (average 16·8 by 4) $\mu$. The pathogen causes the development on the living foliage of angular, necrotic, dark brown to black lesions, up to several cm. in diameter, distinctly areolate on the upper surface, and bearing the conidial stage characterized by fasciculate to lax, geniculate, short, continuous to

pluriseptate, hyaline or pale olive-grey conidiophores, arising from a stromatic base, and subhyaline, cylindrical, curved, very slender, uni- to quinqueseptate, guttulate conidia, pointed at both ends, 16·8 to 112 by 2·2 to 3·5 (47·6 to 72 by 2·8 to 3·5) $\mu$. Ovate to globose, black spermogonia, 30 to 60 by 30 to 50 $\mu$, are scattered in and along the margins of conidial lesions and produce small, rod-shaped, hyaline spermatia, 2 to 4 by 0·5 to 0·7 $\mu$, arising endogenously, usually in fours, and liberated through sterigma-like processes.

The leaf spot, which is believed to be co-extensive with muscadine culture in the south-east, having originally been reported from Alabama (*J. Mycol.*, viii, pp. 62–73, 1902), is in general more prevalent on superior introductions, such as Hunt, Yuga, Creek, Stuckey, and Howard, than on the older varieties, Scuppernong, Flowers, and Thomas. From one season's experience it appears to be controllable by fortnightly applications of 4–5–50 Bordeaux mixture, the first so timed as to precede the initial heavy ascospore discharge in the spring and the treatment continuing during the next four to six weeks. Other possibilities of control lie in stringent vineyard sanitation and the careful selection of breeding stock.

Reinboth (G.). **Die Einsparung von Kupfer bei Pflanzenschutzmitteln in Italien.** [The saving of copper in plant protectives in Italy.]—*Z. PflKrankh.*, li, pp. 441–442, 1941. [Abs. in *Chem. Zbl.*, cxii (ii), 22, p. 2724, 1941.]

Citrus oils and mercury compounds proved ineffectual for the control of [vine] *Peronospora* [*Plasmopara viticola*] in Italy, but excellent results were secured with the 'Casale' Bordeaux mixture and cuprital (utilizing only 0·5 to 0·8 per cent. copper [cf. *R.A.M.*, xvii, p. 583] and consisting of a mixture of 40 per cent. copper sulphate, iron, aluminium, and dipotassium monoxide salts and ammonium compounds).

**Service and regulatory announcements July–September, 1941.**—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 148, pp. 80, 82, 1941.

Uruguay. Decree No. 50 of 4th June, 1941, introduces certain modifications into the Decree of 10th January, 1934, respecting the importation of seed potatoes [*R.A.M.*, xiii, p. 672], all consignments of which must be accompanied by certificates guaranteeing the virtual freedom of the places of origin from *Synchytrium endobioticum* and *Spongospora subterranea*, and the absence from the tubers of other serious parasitic diseases. The presence of powdery scab (*S. subterranea*) entails rejection, the presence of black scab (*Rhizoctonia violacea*) [*Helicobasidium purpureum*: ibid., ix, p. 554] necessitates previous disinfection; while common scab (*Actinomyces scabies*) is permitted to a maximum of 5 per cent. of the tubers and 10 per cent. of the surface.

S. Africa. Under Proclamations Nos. 65 and 87 of 1941, Proclamation No. 286 of 1936, relating to the exclusion of bacterial canker of tomato (*Aplanobacter michiganense*) [ibid., xvi, p. 640] is amended to necessitate the accompaniment of tomato seeds from Germany, Italy, North America, or any other country in which the disease occurs, by an import permit and certificate stating that the seed was produced by plants free from the disease.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
OF
# APPLIED MYCOLOGY

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Maier (W.). **Zur Frage der Stäubewirkung der Kupferkalkbrühe bei der Bekämpfung von Plasmopara viticola.** [On the question of the dust action of Bordeaux mixture in the control of *Plasmopara viticola.*]—*Wein u. Rebe*, xxiii, pp. 65–72, 1941. [Abs. in *Chem. Zbl.*, cxii (ii), 22, p. 2724, 1941.]

In experiments at the Geisenheim [Rhine] Horticultural Research Station the infection of vines by *Plasmopara viticola* was successfully combated by the application of Bordeaux mixture dust to the leaves at the rate of 0·03 mg. per sq. cm., the threshold of toxicity lying at 0·01 mg. The action of Bordeaux mixture in dust form is not, however, strictly comparable to that of the dusts proper.

Storey (H. H.). **Plant pathology.**—*Rep. E. Afr. agric. Res. Sta., 1940*, pp. 7–8, 1941.

In this report [cf. *R.A.M.*, xx, p. 102], the author states that breeding work for resistance to cassava mosaic [ibid., xx, p. 517] and brown streak [ibid., xx, p. 103] has been continued in East Africa. Field tests are made in two stages, a preliminary, unreplicated trial to eliminate the more susceptible clones, and a fully replicated trial. In 1940 two large-scale tests, each of 100 clones in a triple lattice design, were completed, and at the close of the year two further trials, on a changed design, with 96 clones, were planted. The results so far obtained in this work show that few of the 108 varieties imported from overseas are as resistant as the local ones, and most of them have been discarded. Of the cassava × cassava crosses, a few appear, to judge from a single trial, to be more resistant to one or both of the virus groups than any local variety. The *Manihot glaziovii* × cassava hybrids show high field resistance to both groups, though most of them are susceptible to infection by grafting. All the *M. dichotoma* × cassava hybrids except one have resisted the mosaic virus both by grafting and by field infection, and only a few are susceptible to brown streak.

The resistance to streak claimed for the inbred lines of Peruvian Yellow Flint maize [loc. cit.] received from Barberton was again experimentally confirmed.

Larter (L. N. H.). **Report of the Plant Pathologist.**—*Rep. Dep. Sci. Agric. Jamaica, 1940–41*, pp. 13–14, 1941.

Croucher (H. H.). **Report of the Leaf Spot Control Officer.**—loc. cit., pp. 14–15.

Leach (R.). **Report of the Leaf Spot Mycologist.**—loc. cit., p. 15.

In his report on plant disease work in Jamaica [cf. *R.A.M.*, xx, p. 153] the Plant Pathologist states that during the period under review Panama disease of bananas (*Fusarium oxysporum* [var.] *cubense*) continued to spread steadily. The number of cases treated amounted to 781,077, including 1,210 new cases, but the decrease since the previous year indicated by these figures is only apparent, as treatment has now been abandoned over large areas, where infection is no longer controllable.

Bacterial heart rot of bananas was occasionally observed, but there was no sign that the disease is becoming serious.

A local outbreak of banana fruit stalk rot (navel rot) occurred in parts of St. Thomas.

This condition, apparently not previously recorded, consisted in a progressive rot of the fruit stalk, beginning in the interior of the terminal inflorescence bud ('navel') and spreading back along the peduncle until, in some cases, the fruit was reached. As a rule, plants became affected when the fruit was from half to three-quarters full, and environmental conditions caused cessation of filling out of the fruit, followed by premature ripening, rotting, and shedding of the fingers. No primary pathogenic organism was associated with the disease, which, apparently, was not infectious. Abnormal soil moisture conditions may have been responsible. As a precaution, the navels were removed when the fruit was half mature, with the result that the disease practically disappeared.

Coco-nut bronze leaf wilt [loc. cit.] remained confined to the north-west of Jamaica, where, except on a few properties, it has to a large extent destroyed the coco-nut cultivations. Its rate of spread has, however, much decreased, and it has not extended to the adjoining parishes of Trelawny and Westmoreland.

Rust (*Puccinia psidii*) [loc. cit.] continues to be the limiting factor in the pimento (*Pimenta officinalis*) crop.

With increased groundnut production the disease situation has become more serious. Root rot (*Sclerotium rolfsii*) [ibid., xix, p. 579] was frequently reported, and caused heavy losses. Rust (*P. arachidis*) [ibid., xix, p. 261], though seldom severe, is widespread. Wilt (*Fusarium* sp.) [cf. ibid., xix, p. 62] appears likely to become more troublesome. Other groundnut diseases observed include damping-off (? *Phoma* sp.), leaf blight (*Gloeosporium* sp.), and leaf spot (*Cercospora personata*) [ibid., xx, pp. 448, 450]. Both the last-named disease and *Fusarium* wilt appear to be new records for Jamaica.

A few severe, isolated outbreaks of cassava leaf spot (*C. henningsii*) [ibid., xx, p. 445] following the autumn rains cleared up after spray treatment.

New records (other than those cited above) included sunflower rust (*Puccinia helianthi*), and leaf spot (*Diplodia macrospora*) and a heart rot (apparently bacterial) of maize.

In the report by the Leaf Spot Control Officer it is stated that the intensity of banana infection by the disease [*C. musae*: ibid., xx, pp. 153, 412] was subject to the usual seasonal fluctuations. Control in certain areas, particularly in the Western Division, was made difficult by rain. Towards the end of 1940 high winds and low temperatures severely affected the appearance of the bananas. In sections of St. Mary and St. Catherine unfavourable weather and unsatisfactory cultivation were more important factors than leaf spot. Good quality fruit is still produced in the absence of control in the eastern parishes, though the average intensity of infection here has increased. The total number of growers in Jamaica who regularly practise spraying is estimated at about 900. All who have been issued with equipment are visited by officers of the company with which they have a contract, who are responsible for the supervision of the spraying. Two properties were taken over for field experiments and planting out was to be done in April and May, 1941. Investigations are to be based on the assumption that if the crop is to bear the additional expense of spraying, production per acre must be increased.

The Leaf Spot Mycologist [cf. ibid., xx, p. 265] states that present spraying methods achieve control by reducing sporulation on sprayed spots and by rendering the dew toxic to any spores produced on the treated leaves. Comparative tests with Bordeaux mixture and perenox (both in use under the direction of the Banana Leaf Spot Control Board) showed that the former suppresses sporulation much more effectively than the latter, while, vice-versa, dew from perenox-sprayed leaves is more toxic to germination than dew from leaves sprayed with Bordeaux mixture. Preliminary tests with heart-leaf spraying, using a spray with a high wetter content, have resulted in a remarkably high level of control, and may form a basis for improved spraying methods,

**I Congresso nacional de Ciências naturais. Comunicações.** [First National Congress of Natural Sciences. Communications.]—*Rev. agron., Lisboa*, xxix, 1, pp. 96, 100, 107–110, 115–117, 1941.

The following are summaries of papers presented at the First National Congress of Natural Sciences, held in Lisbon from 6th to 11th June, 1941. R. V. De G. Cabral, dealing with the serious olive disease caused by *Gloeosporium olivarum* [*R.A.M.*, xiv, p. 596], states that inoculation experiments on the fruits of olive and grapefruit gave uniformly positive results, all other parts of the plants, however, reacting negatively. The optimum temperature for the development of the pathogen was found to be 27° C., but spore production was equally abundant at 22° and 24°.

The fourth contribution by M. De S. Da Camara and C. G. Da Luz to the fungi of Portugal [cf. ibid., xix, p. 365] comprises 69 species, including 37 not previously recorded in Portugal.

B. D'Oliveira describes the reproductive and cytological processes in the rusts *Puccinia anomala*, *P. rubigo-vera* [ibid., xx, p. 353], *Tranzschelia* [*P.*] *pruni-spinosae*, *Uromyces graminis*, *U. fabae* [ibid., xix, p. 167], and *U. vignae* [ibid., x, p. 810], with special reference to the intervention of the sexual phase in the formation of new physiologic races or even varieties. The same author discusses the physiological relations of *Darluca filum* [ibid., xx, p. 570] and *Tuberculina* spp. with the rusts which they parasitize and the hosts of the latter. Observations on infected tissues led to the conclusion that the secretions of the rusts, or the metabolic products of the host, rather than the rusts themselves supply the hyperparasites with nutriment. *D. filum* was found to be associated exclusively with the uredo-teleutospore phase, and *T. persicina* [ibid., xix, p. 433] with the aecidial phase of *U. vignae* on the same cowpea leaf.

B. D'Oliveira and Maria De L. V. Borges showed that the mycelium of *P. pruni-spinosae* in the rhizomes of *Anemone coronaria* [cf. ibid., xx, p. 81] perennates in a haploid condition, even in plants with fertile aecidia on the leaves.

B. D'Oliveira and A. A. L. Pimentel observed *Melampsoridium betulinum* [ibid., xv, p. 326] to be widespread in the uredo- and teleutospore stages on *Betula celtiberica* in the province of Tras-os-Montes, where the alternate host (larch) is rare. Laboratory experiments in the spring of 1940 showed that the dissemination of the rust may be effected by the uredo stage and by dormant bud infections.

Maria De L. D'Oliveira concludes, from a perusal of the relevant literature, that a virus disease of onion, garlic, grape-hyacinth (*Muscari comosum*), and *Narcissus tazetta* observed in the spring of 1940 is identical with yellow dwarf [ibid., xx, p. 442], but cross-inoculation experiments have not yet been undertaken.

The following bacterial diseases have been studied by Maria De L. D'Oliveira and R. V. De G. Cabral: *Phytomonas* [*Pseudomonas*] *savastonoi* on olive [ibid., xx, p. 504], *Bacterium ligustri* on privet (*Ligustrum japonicum*), *Erwinia carotovora*, causing a soft root rot of various horticultural plants, *Bact.* [*Xanthomonas*] *juglandis* on walnuts, *Bact.* [*X.*] *phaseoli* on beans [*Phaseolus vulgaris*] in Madeira but not encountered in Portugal, *Phytomonas* [*Pseudomonas*] *syringae* on lemons [ibid., xix, p. 274], and *Phytomonas begoniae* (Takimoto) comb. nov. [but see Bergey, Manual of determinative bacteriology, p. 162, 1939: *X. begoniae* (Buchwald) Dowson] on *Begonia tuberosa*.

A. T. De Vasconcellos and B. D'Oliveira studied the pathogenicity of *Saprolegnia parasitica* to various kinds of fresh-water fish [*R.A.M.*, xviii, p. 799], which suffer severely from its attacks, notably in tanks and aquaria. The fungus was isolated in pure culture and found to be capable of infecting unwounded fish living under hygienic conditions.

A. Zagallo, studying the influence of temperature on the development of *Coryneum longistipitatum* [a pathogen of pear: cf. ibid., x, p. 704] on Dox's agar, found that conidial germination takes place at a range of 2° to 28° C., with an optimum at 22°.

at which 97·8 per cent. germinate in nine hours, the same temperature also favouring mycelial growth. The temperature range for conidial production lies between 5° and 22°, with an optimum at 12°.

**Plant diseases. Notes contributed by the Biological Branch.**—*Agric. Gaz. N.S.W.*, lii, 12, pp. 642–645, 6 figs., 1941.

Under New South Wales conditions bean rust (*Uromyces phaseoli typica*) [*U. appendiculatus*] is almost exclusively confined to the climbing varieties of French beans [*Phaseolus vulgaris*: *R.A.M.*, xx, p. 556], among which Epicure is particularly susceptible, followed by Kentucky Wonder and Glory of Summer. Pending the development of resistant varieties, control should be based on early planting, enabling the crops to outdistance the rust, and the weekly or fortnightly application, at the first sign of infection, of a dust consisting of equal parts of sulphur and hydrated lime.

Besides tomatoes, which have again sustained heavy damage by the spotted wilt virus in recent months, lettuce, potatoes, tobacco, and a number of popular ornamentals are subject to infection. Sanitary measures against the disease should comprise the exclusion of susceptible flowering plants, such as dahlia, *Zinnia*, and nasturtium [*Tropaeolum majus*] from the vicinity of tomato plots; prompt removal and destruction of diseased plants on the first sign of the disease; washing the hands in soapy water before renewed contact with healthy plants; destruction of weeds in the neighbourhood of the plots; staking and pruning of the plants; and (for smallholders) postponement of planting until December so as to avoid severe attacks.

Heavy losses have been caused from time to time during recent years in the late cherry-producing districts of the Central and Northern Tablelands by brown rot (*Sclerotinia fructicola*), amounting at Orange, for instance, from 1933 to 1935 to between £10,000 and £15,000. One of the means of combating this destructive pathogen consists in the application, during the week before picking, of a sulphur-containing fungicide, e.g., lime-sulphur 1 in 160, colloidal sulphur 2 in 100, or a combination of the two at half the strengths indicated. Alternatively, copper oxychloride (available on the market under the names of soltosan, cuprox, and oxy-cop) is tentatively recommended at the rate of 1 lb. per 160 gals. water; this compound, unlike Bordeaux mixture, does not leave an unsightly deposit on the fruit. Bordeaux mixture has also been found effective against prune rust [*Puccinia pruni-spinosae*], but its use in non-irrigated areas tends to cause severe leaf scorch, and copper oxychloride (as before) or lime-sulphur (1 gal. per 160 gals. water) is accordingly recommended as an alternative; colloidal sulphur (1 to 2 lb. per 100 gals.) or wettable sulphur (2 to 5 lb.) should be combined with either of the compounds, which are normally applied once in late October and again between mid-December and mid-January.

New disease records for October, 1941, include leaf spot of foxglove (*Digitalis purpurea*) caused by *Ramularia variabilis* [ibid., ix, p. 185], ergot of red grass (*Bothriochloa* sp.) due to *Claviceps pusilla* [ibid., xxi, p. 82], crown rot of silver beet (*Beta vulgaris*) (*Rhizoctonia* [*Corticium*] *solani*), and *Epichloe cinerea* on Parramatta grass (*Sporobolus indicus*).

**Divisions of Plant Pathology and Seed Investigations.**—*Rep. N.Y. St. agric. Exp. Sta., 1940–1*, pp. 33–40, 50–55, 1942.

During the period under review [cf. *R.A.M.*, xx, p. 244], apple scab (*Venturia inaequalis*) was, as usual, effectively combated by wettable sulphurs, a number of which were found to be improved by the admixture of 1 in 100 spray lime, especially if orthex [ibid., xviii, p. 236] is included in the formula as a sticker, or under humid conditions. Magnetic '70' and the flotation sulphur pastes should be applied at the rates of 5 and 10 in 100, respectively. Of the dry wettable sulphurs, the micronized (5 in 100) proved to be the most toxic to the fungus. Bordo $\frac{3}{4}$–6–100 plus micronized sulphur $2\frac{1}{4}$–100 caused the least copper injury of any copper material tested in the

first cover spray, possibly excepting coposil, but the sulphur content still exceeds the safety limit if the second cover is to include summer oil. The most promising of the new preparations tested was IN870, a Du Pont organic compound, which was also highly specific against the cedar rusts [*Gymnosporangium juniperi-virginianae* and other *G.* spp.]. Ground treatments of 0·5 per cent. elgetol [ibid., xxi, p. 82] or ammonium sulphate (100 lb. per 100 gals. water) plus a penetrating agent, applied before the green tip stage was reached, gave excellent control of scab in orchards with a heavy carry-over, whereas 10 per cent. infection developed on the fruit in comparable sites where the ground spray was omitted.

Lime-sulphur and flotation sulphur controlled leaf spot (*Coccomyces hiemalis*) on Montmorency cherries [ibid., xxi, p. 148] only when applied before infection periods, magnetic '70' sulphur paste being far superior to the foregoing in a test on the Morello variety in which the disease became established at the time of the 'shuck' spray, while in another trial under more exacting conditions the insoluble coppers, especially No. 375 (U.S. Rubber Co.), definitely surpassed the sulphur preparations in toxicity to the pathogen. The high degree of efficacy of Bordo 1½–6–100 was counterbalanced by its tendency to injure the trees and reduce yields. Bordow was the best of the dry commercial coppers used in the experiments, but the most successful of all the materials tested was IN870.

Outstanding results in the control of raspberry spur blight (*Didymella applanata*) over an experimental period of three years [ibid., xx, p. 245] have been obtained by the application of 1 per cent. elgetol to the canes when the green tips protrude about ¼ in. from the buds.

Two applications of Bordeaux 3–3–100, the first when the fruits are about half-grown and the second after picking, were equally effective with the 8–8–100 formula and the insoluble coppers against currant leaf spots (*Mycosphaerella grossulariae* and *Pseudopeziza ribis*), which were also eliminated from gooseberries by an insoluble copper or high-lime Bordeaux. Powdery mildew of gooseberries (*Sphaerotheca mors-uvae*) yielded to a single application of 1 in 50 lime-sulphur.

Spergon [ibid., xx, p. 241], cuprocide, and semesan, used at the rates of 1 to 2, 2½, and 2½ oz. per bush., respectively, were the best of the pea seed disinfectants tested, producing yields from half-acre plots of 200 to 1,800 lb. more shelled peas per acre than the untreated controls. Cuprocide, however, caused moderate injury in two fields, while new improved ceresan (1 oz.) consistently retarded growth and reduced output. Foot and root rots (chiefly associated with *F. solani* var. *martii* f. 2 and *Aphanomyces euteiches* [ibid., xx, p. 245]) were prevalent and severe during the damp growing season of 1940, but notwithstanding the presence of disease the average yields exceeded those of the past ten years by some 400 lb. per acre. Of the fungi concerned, *F. solani* var. *martii* f. 2 has been found to occur annually in a destructive form over the last four years, irrespective of weather conditions; in a wet planting season it may also be responsible for serious seed decay. *A. euteiches* is more dependent on the weather, being unimportant or absent during a dry spell. *Pythium ultimum* and *Corticium solani* may both be implicated in the causation of foot and root rots, but the former is primarily pathogenic to seed and seedlings and the latter has never been observed in connexion with an epidemic.

Satisfactory control of tomato blight [*Septoria lycopersici*] was secured by treatment with Bordeaux mixture 4–2–50, copper oxychloride sulphate, Grasselli compound A, cuprocide 54–Y, yellow cuprocide, and Tennessee tribasic [ibid., xx, p. 181], the gross return from spraying on half-acre blocks in commercial fields being computed at $13 to $54 per acre.

Three out of five lines of mosaic-resistant hybrid Refugee beans [*Phaseolus vulgaris*: ibid., xx, p. 245] produced at the Station outyielded U.S. No. 5 and Idaho Refugee, but only one of these was adapted for canning purposes.

For the control of hop downy mildew [*Pseudoperonospora humuli*: ibid., xx, p. 246]

yellow cuprocide 1 in 100 should be substituted for Bordeaux in the early June sprays, when the latter preparation may cause severe leaf and shoot injury, and in those of August to obviate the adhesion of a deposit to the fruit. Preventive treatments were effective except in yards where infection had reached the upper parts of the vine before the application of the first spray. In situations promoting such premature development of the fungus weekly roguing of the basal spikes resulting from primary infection was necessary. Timely spraying or dusting with sulphur was efficacious against powdery mildew [*Sphaerotheca humuli*], while both hop diseases proved amenable to a combination of sulphur and red cuprous oxide dusts containing 6 per cent. by weight of copper. Tests are in progress of several hop varieties showing promise of resistance to both pathogens.

*Fusarium moniliforme* [*Gibberella fujikuroi*] developed in 30 per cent. of the routine germination tests of field maize, and was also found in 91 out of 94 samples of field and 18 out of 21 of sweet maize collected by State inspectors [ibid., xx, p. 528; xxi, p, 72].

Crucifer seeds sold in packets are commonly infected by *Alternaria brassicae* and *A. circinans* [*A. oleracea*: ibid., xix, p. 636], both of which, together with *Rhizopus nigricans*, are usually eliminated by ethyl mercury tartrate, phenyl mercury cyanamide, and other mercury compounds in laboratory tests.

BITANCOURT (A. A.). **Plant diseases observed in the State of São Paulo in 1939 and 1940.**—*Int. Bull. Pl. Prot.*, xv, 12, pp. 221M–223M, 1941.

The following, in addition to records already noted from other sources, are among the diseases observed in São Paulo, Brazil, in 1939 and 1940 [cf. *R.A.M.*, xix, p. 329]: *Himantia stellifera* on sugar-cane [ibid., xviii, p. 346], *Cytospora cydoniae* Rangel on quince, *Entyloma dahliae* on *Dahlia variabilis*, *Uromyces fabae* on broad bean, *Fusarium moniliforme* [*Gibberella fujikuroi*] on fig, *Cercospora fusca* on pecan [ibid., xix, p. 330], *Fabraea maculata* on apple, *C. krugiana* on *Boehmeria nivea* [ibid., xvi, p. 344], *Botryobasidium* [*Corticium*] *solani* on tobacco, and *F. bulbigenum* var. *lycopersici* on tomatoes.

**Informe anual correspondiente al año agrícola 1940–1941.** [Annual report for the agricultural year 1940–1941.]—*Bol. Chacra exp. 'La Previsión'*, iii, 2, pp. 59–81, 110–111, 5 graphs, 1941. [English summary.]

Among the items of phytopathological interest in this report on the work of a cooperative experimental farm in the province of Buenos Aires, Argentine, in 1940–1, may be mentioned the following. Foot rot (*Ophiobolus graminis*) [*R.A.M.*, xv, p. 209] occurred sporadically, causing heavy damage to the summer wheats (*Triticum durum*) used in the manufacture of spaghetti, infection being favoured by the almost universal practice of sowing the new crop among the stubble of the foregoing.

Brewing barleys were heavily infected by the leaf-spotting fungi, *Helminthosporium* spp. [ibid., xv, p. 296] and *Rhynchosporium* [*secalis*].

The most important flax disease was 'spasm' (*Septoria linicola*) [*Sphaerella linorum*: ibid., xx, p. 18], rust (*Melampsora lini*) and wilt (*Fusarium lini*) causing relatively little injury.

Tables are given showing the results of inoculation experiments with *Tilletia* [*caries* and *T. foetida*] on a number of wheat varieties, some of which were tested over a seven- and others over a six-year period. The only resistant variety in the former lot (average infection from 1934 to 1940, 0·9 per cent.) was a selection of Kanhard made at 'La Previsión'; two were semi-resistant, viz., Kanred and Kanhard (6·9 and 13·8 per cent., respectively), Eureka was semi-susceptible (36·3), while the 'La Previsión' selections 34 and 25 were susceptible, with 64·6 and 74·5 per cent. infection, respectively. The six-year group comprised three resistant varieties, namely, Oro, a summer wheat selection made at 'La Previsión', and Cooperatorka selection M.A. (average infection from 1935 to 1940, 0·3, 1·2, and 3·3 per cent., respectively), and three semi-

susceptible, i.e., Reliance selection Klein, Sola 50–10/33, and Standard (18·8, 34·7, and 44·7, respectively). A 'common' summer wheat (pure *T. durum*) tested in four seasons only was resistant (2·8 per cent. infection from 1937 to 1940), the corresponding figure for a type comprising an admixture of *T. aestivum* being 10 per cent.

Of the four barley varieties tested for their reactions to *Ustilago hordei* during the five-year period from 1936 to 1940, only one (Fodder R.M.85) was resistant, with an average infection of 0·7 per cent. resulting from the inoculation of hulled seed, the other three, viz., Aclimatada Rivera, La Previsión 19 (both brewing), and Fodder Trebi, being semi-resistant, with 7·5, 9·1, and 9·5 per cent. infection, respectively, while the corresponding percentages for dehulled seed were 7·9, 47·0, 49·1, and 34·7, respectively. A brewing selection, II–13×F.common 37–1, and a fodder barley, II–13×F.common 7–2, were both tested in three seasons, during which the former was resistant (2·8 and 19·3 per cent. infection for hulled and dehulled seed, respectively, from 1938 to 1940), and the latter susceptible (9·7 and 43·8 per cent., respectively).

La Previsión 34 wheat severely attacked by *Puccinia graminis tritici* in 1940–1 was divided into three different lots for harvesting, of which (1) and (2), containing 40 and 21 per cent. moisture, respectively, were cut on 26th December and 1st January, respectively, and left lying in rows in the field until 23rd January, while (3), with 10 per cent. moisture, was gathered on 16th January; the yields from the three lots amounted to 82, 99, and 229 kg. per ha., respectively, the 1,000-grain weights being 14·42, 15·90, and 13·72 gm., respectively.

BROWN (NELLIE A.). **The effect of certain chemicals, some of which produce chromosome doubling, on plant tumors.**—*Phytopathology*, xxxii, 1, pp. 25–45, 2 figs., 1942.

From this detailed, fully tabulated account of the writer's experiments on the action of various chemicals on plant tumours caused by *Bacterium tumefaciens*, it appears that the chromosome-doubling chemicals acenaphthene, α-methylnaphthalene, α-nitronaphthalene, 3–5–dibromopyridin, and apiole did not induce excessive doubling of the chromosome of young tumours like colchicin [*R.A.M.*, xix, p. 461]. The only stimulus to growth conferred by acenaphthene took place in young galls on French marigold (*Tagetes patula*) and Paris daisy (*Chrysanthemum frutescens*) brushed with this substance dissolved in chlorinated naphthalene, and temporarily also in the former host watered with a saturated aqueous solution of acenaphthene. Dissolved in dioxan, acenaphthene failed to induce the marked gall enlargement before inhibition and death typical of the effects of colchicin treatment. Marigold tumours were not killed by 3 per cent. acenaphthene in dioxan, which was, however, lethal to galls on *C. frutescens* of 36 days old and upwards. Generally speaking, any inhibition of growth in marigold tumours due to acenaphthene was overcome, and at maturity the treated galls were no smaller than the controls.

Galls brushed with full-strength apiole, an oily, non-volatile compound extracted from parsley seed, did not attain their normal size, but were not killed by the treatment. On the other hand, full-strength α-methylnaphthalene, brushed on young marigold and *C. frutescens* tumours, suppressed further growth and killed old but still developing galls on both hosts, much the same effects being produced by a 50 per cent. emulsion of the compound, using santomerse [ibid., xix, p. 187; xxi, p. 111] as the emulsifying agent. Applications of α-methylnaphthalene to the excrescences on two related hosts, *Bryophyllum pinnatum* and *Kalanchoë daigremontiana* [cf. ibid., xvii, p. 798; xviii, p. 580], failed to retard the growth of those on the former, while the galls on the latter were dead in a fortnight.

Uniformly negative results were obtained with α-nitronaphthalene and 3–5–dibromopyridin in saturated water solutions and lanoline paste. Two chemicals used by animal pathologists in the control of mouse tumours, viz., heptyl aldehyde and

methyl salicylate, were included in the trials. Used at full strength normal heptyl aldehyde destroyed twelve 14-day-old marigold tumours in 24 hours, while only slight shrinkage occurred in the same number of 18-day-old galls on *C. frutescens*, half of which survived the treatment and continued to grow. In a 20 per cent. emulsion the same compound killed twenty 25-day-old marigold tumours in three days, but did not injure those of a week old: ten 46-day-old galls on *C. frutescens* succumbed to a 10 per cent. emulsion of heptyl aldehyde. Full strength α-methyl salicylate killed 30- to 44-day-old tumours on marigold, but not those of 12 to 15 days: in the case of *C. frutescens*, 16- to 26-day-old excrescences were killed and those of a week old inhibited by brushing with the chemical.

Waksman (S. A.), Woodruff (H. B.), & Horning (Elizabeth S.). **The distribution of antagonistic properties among Actinomycetes.**—Abs. in *J. Bact.*, xlii, 6, p. 816, 1941.

On the basis of their chemical properties and biological activities the active substances so far demonstrated for Actinomycetes can be divided into four groups, viz., (1) actinomycetin, (2) the lysozyme type of substance studied by Russian workers, (3) actinomycin, isolated from *Actinomyces antibioticus* [*R.A.M.*, xx, p. 595], and (4) streptothricin, a new type of compound on the isolation of which the writers are at present engaged. It is water-soluble, thermostable, less toxic, but much more specific in its bacteriostatic action, particularly against various Gram-negative organisms.

Allcroft (Ruth). **Antibacterial agents derived from micro-organisms with special reference to gramicidin.**—*Vet. Bull., Weybridge*, xii, 1, pp. R1–R6, 1942.

The author reviews and discusses the results obtained in recent research on antibacterial agents derived from micro-organisms, including (among others) penicillin [*R.A.M.*, xx, p. 484], Glister's agent from *Aspergillus* (?) [ibid., xxi, p. 67], actinomycin [see preceding abstracts], and gramicidin. The last-named, which exerts a strongly bacteriostatic and bactericidal effect on Gram-positive micro-organisms, is best obtained from *Bacillus brevis*. Very promising results with gramicidin have already been obtained in the control of chronic bovine mastitis.

Melchers (L. E.). **The Wheat stem rust epidemic of Kansas in 1940.**—*Plant Dis. Reptr, Suppl.* 132, pp. 95–103, 3 graphs, 1 map, 1941. [Mimeographed.]

During the six-year period from 1935 to 1940 the total loss from black rust of wheat (*Puccinia graminis tritici*) in Kansas equalled or surpassed the combined reduction for all previous seasons since the epidemic of 1904. In 1935, 1937, 1938 [*R.A.M.*, xix, p. 203], and 1940 the losses incurred as a result of the disease were of major significance, the decrease in yield for the State in the last-mentioned year being estimated at 7 per cent., or roughly 9,321,892 bush. A graph of the daily precipitation and maximum and minimum temperatures from 1st April to 30th July indicates that moisture was favourable up to the middle of July but the temperatures remained too low throughout April for rust development. Several prolonged as well as short periods favourable to infection occurred from 5th May to 12th June and it was during these periods that infection spread and made way for the epidemic that followed. The main favourable periods were later in 1940 than in other years and continued into late June and the first two weeks of July, whilst the wheat crop in southern, central, and parts of eastern Kansas was 10 to 14 days late and stem rust consequently had time to spread and injure the crop. The wheat crop in the north-central counties was a fortnight in advance of the crop in the southern part and remained rust free.

Attempts are in progress to secure a rust-resistant hard red winter wheat by hybridization, none of the varieties of this type at present grown in the State being satisfactory in that respect; of the other hard kinds, Early Blackhull, Blackhull, Kawvale, and Iobred sustained the least damage.

Săvulescu (T.). **Wheat rusts and Wheat scald during the year 1940. II. Scald.**—*Int. Bull. Pl. Prot.*, xv, 11, pp. 201M–205M, 1941.

The poor Rumanian wheat crop of 1940 is attributed largely to a physiological disturbance known as 'scald', aggravated by rusts [*Puccinia* spp.], particularly black rust [*P. graminis*]. 'Scald', which results in the production of small, light, shrivelled grain, was most prevalent in districts where heavy rains caused lodging and in those where the crop was overtaken by excessive heat in the 'milky' stage. An attack of 'scald' at this juncture causes the premature desiccation not only of the grain, but also of the last internode of the stalk, thereby precluding the normal synthesis of reserve substances. 'Scalded' grains are apt to develop cracks in the tegument, especially near the embryo, which may also suffer damage, while injury is further liable to arise from the percolation through the fissures of the chemical solutions or dusts used for disease control. 'Scalded' seed-grain usually germinates normally, but the seedlings are small, weak, with stunted roots, and often fail to tiller; if the autumn is dry, many die off, and in the winter they are very susceptible to frost. In 1940 the combined losses from rust and 'scald' amounted to between 50 and 70 per cent. of the normal crop. 'Scald' was particularly severe on the spring varieties, Ulca and Arnaut, while *Triticum ferrugineum* sustained heavier damage than *T. erythrospermum*, and awned varieties were more severely attacked than unbearded ones.

Preventive measures against scald should include the replacement of unselected populations by pure lines, e.g., American 15, adapted for cultivation in the several wheat-growing regions of Rumania and characterized by resistance to cold, drought, scald, and rusts rather than high productivity; strict attention to cultural operations; ceaseless vigilance in the pursuance of the barberry eradication campaign, especially in the Carpathians, Prahova and Siret Valleys, and Danube Delta, where the bushes form veritable thickets; and the sowing of larger quantities of seed-grain than usual in the autumn following 'scald' attacks so as to compensate for losses during germination and in consequence of winter frosts.

Holton (C. S.) & Suneson (C. A.). **Varietal reaction to bunt in the western Wheat region of the United States.**—*J. Amer. Soc. Agron.*, xxxiv, 1, pp. 63–71, 1942.

The results obtained from 1932 to 1940 with 83 wheat varieties and hybrid selections tested for bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetida*] reaction during one or more years at 11 co-operating stations in five western [*R.A.M.*, xx, p. 347] States and one in West Virginia are tabulated and discussed. The inoculum was procured either from commercial wheat fields in the vicinity of each nursery or from a composite of collections from fields distributed over the entire Pacific Northwest.

None of the varieties was free from infection at all the stations, though 36 averaged less than 10 per cent. and 7 less than 1 per cent., viz., Hussar × Hohenheimer (10068–1), three lines of Relief × Ridit (11908, 11905, and 11904), two of Oro × Turkey-Florence (11865 and 11864), and Ridit × Hohenheimer (11760). Five resistant varieties, namely, Ridit, Relief, Hussar, Hohenheimer, and Turkey-Florence, were involved in the production of 26 out of 27 of the most promising hybrid selections. In eight of the twelve nurseries the majority of the infected varieties and selections showed less than 10 per cent. bunt. In general, the more virulent races of bunt were fairly prevalent throughout the region of the tests.

In 1940–1 the percentage of carloads of wheat graded as smutty at Pacific Northwest inspection points was only 8·6 compared with 43·7 in 1922–3.

Hirschhorn (Elisa). **Algunos caracteres de las 'Tilletia' spp. que producen las 'caries' del Trigo en la chacra experimental 'La Previsión'.** [Some characters of the *Tilletia* spp. which produce Wheat 'bunts' at the 'La Previsión' experimental farm.]—*Bol. Chacra exp. 'La Previsión'*, iii, 2, pp. 105–109, 1 fig., 1941.

A careful examination of a large quantity of summer wheat bunt (*Tilletia tritici*

and *T. levis*) [*T. caries* and *T. foetida*] material collected in the Barrow district of the Argentine from 1931 to 1940 revealed the existence of a number of hybrid forms or races with distinct morphological characters. To cite some examples, a lot collected in 1931–2 was characterized by very hard, black sori, some containing typical chlamydospores of both species, while others on the same ear were occupied either by densely reticulate or almost entirely smooth ones of variable shape and diameter; in other samples the sori were pale chestnut-coloured and very soft, black and moderately hard, black, hard, and broken, or cinnamon-coloured and very soft, while the chlamydospores were lemon-yellow, chestnut-golden, dark golden, faintly reddish, quasi-hyaline, olive-grey, or yellow-olive, smooth or very faintly reticulate, markedly verrucose, or punctiform. Some 95 per cent. of the chlamydospores, both typical and aberrant, collected in 1939–40 germinated, many producing typical promycelia with basidiospores and secondary sporidia; in other cases the promycelia deviated from the normal in various particulars, e.g., absence of apical basidiospores, pronounced differences in length, malformations, granular protoplasm, ramifications, the formation of one apical and one lateral sporidium, or the development of the typical apical basidiospores, but without clamp-connexions and supplemented by a lateral sporidium, or of a terminal sterigma with no sporidia.

The morphological and physiological heterogeneity arising from this interspecific hybridization greatly complicates the development of bunt-immune wheat varieties, both by reason of the high degree of virulence attainable by such new homo- or heterozygotic races of the fungi concerned, and of the instability of the host reactions to the aberrant forms of the pathogen thus formed.

FORSTER (H. C.) & CROLL (R. D.). **Varietal resistance to foot-rots in Wheat.**—*J. Aust. Inst. agric. Sci.*, vii, 3, pp. 121–123, 1941.

In 1940 wheat at the State Research Farm, Werribee, Victoria, developed exceptionally severe infection by foot rot, due mainly to *Fusarium* spp. Counts of affected heads on four varieties, sown at different times in separate locations gave 20·1, 19·3, 22·4, and 26·1 per cent. infection for Baldmin wheat sown on 10th, 15th, 15th, and 31st May, respectively, the corresponding figures for Sepoy being 24·3, 11·5, 15·1, and 14 per cent., respectively, for Ranee 4H 10·1, 9·3, 17·4, and 4·5 per cent., respectively, and for Ghurka 13·8, 6·7, 9, and 6·6 per cent., respectively. The mean figures for the four varieties in the different situations were 22, 16·2, 10·3, and 9 per cent., respectively, and those for the different locations (all varieties) 17·1, 11·7, 16, and 12·8 per cent., respectively. Statistical examination of these figures demonstrated that the differences produced by variety, location (and/or time of sowing), and the interaction between the two were all significant. Variance for varieties was not only significantly greater than variation within the plant, but was also greater (>1 per cent.) than the variety×location variance. Hence, (a) varietal resistance was demonstrated, (b) different sites and/or sowing dates had a significant effect on the relative order of the varieties, in so far as severity index was concerned, and (c) the average over-all resistance of the varieties was significantly greater than variation due to (b).

Counts for a number of varieties from each of four plots sown on different dates and in different parts of a paddock showed that Baldmin, Free Gallipoli, Quadrat, Sepoy, Pindar, Magnet, Ranee 4H, Ghurka, and Regalia had, respectively, 21, 20, 17, 16, 13, 10, 10, 9, and 8 per cent. infection. Attention is drawn to the fact that late- and early-maturing varieties occur at each end of the list.

It is concluded that varietal resistance was present under the conditions existing, and that, even if varieties with complete resistance cannot be obtained, it should be possible to use the more resistant types to breed wheats that show considerable tolerance.

ZAZHURILO (V. K.) & SITNIKOVA (Mme G. M.). **Diagnosis of virus diseases of cereals.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxx, 7, pp. 664–666, 1 fig., 1941.

By microscopic investigations on healthy wheat, rye, barley, oats, and other cereals and on similar plants attacked by winter wheat mosaic [*R.A.M.*, xx, p. 522] and pupation disease [ibid., xxi, p. 9], and by a comparison of the results with data on other virus diseases of cereals, it has been possible to give diagnostic anatomical and cytological characters for certain virus diseases. Wheat viruses 1 and 1A of McKinney [ibid., iii, p. 452] give vacuolar bodies but no phloem necrosis or protein crystals. Both vacuolar bodies and phloem necrosis are characteristic of winter wheat mosaic, while pupation disease gives protein crystals in addition. External appearance alone affords no basis for identification. Using this method winter wheat mosaic was identified in samples from Moguilev, Riazan, Orel, Kursk, Voronezh, Saratov, Kuibyshev, Autonomous Soviet Socialist Republic of Volga Germans, Sumy, Kharkov, Zaporozhie, Rostov, and Krasnodar.

RIAKHOVSKY (N. A.) & FEDULAEV (A. L.). **Biochemical modifications in the cereals affected with the virus of winter Wheat mosaic.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxx, 7, pp. 667–668, 1941.

The chief results of an analysis of millet [? *Panicum miliaceum*], oats, and winter wheat attacked by winter wheat mosaic virus [see preceding abstract] and of healthy control plants were that in diseased plants (1) the mono- and disaccharides (and in the case of millet only the combined content of starch and hemicellulose) are greatly increased in amount; (2) the total and protein nitrogen is somewhat lower; and (3) the phosphorus content of the leaves tends to be lower.

REED (G. M.) & STANTON (T. R.). **Susceptibility of Lee × Victoria Oat selections to loose smut.**—*Phytopathology*, xxxii, 1, pp. 100–102, 1942.

A table is given showing the reactions to a new race of *Ustilago avenae*, collected at Stillwater, Oklahoma, in 1934, and designated A-30, of the Lee and Victoria varieties of oats and 22 selections from crosses between them in inoculation tests at the Brooklyn Botanic Garden in 1941. The parents, Lee and Victoria, contracted, respectively, 92·6 and 43·8 per cent. infection, the incidence of which among the crosses ranged from 6·6 in P34-1-2-1 (C.I. 3400) to 68 per cent. in P34-9-1-1 (C.I. 3406). The new race is of special interest as being pathogenic to the otherwise uniformly resistant Victoria. In further tests three selections from a cross between Victoria and Hairy Culberson showed 52·3 to 70·8 per cent. infection as a result of inoculation with *U. avenae* A-30, to which, on the other hand, the progeny of crosses of Victoria with Fulgrain, Norton, and Nortex, proved resistant; Nortex itself appeared to be resistant as did also Ranger, Rustler, Fultex, Bond, Markton, and Navarro, Black Mesdag, and Red Rustproof [*R.A.M.*, xx, pp. 160, 357, *et passim*].

MURPHY (H. C.), STANTON (T. R.), & COFFMAN (F. A.). **Breeding for disease resistance in Oats.**—*J. Amer. Soc. Agron.*, xxxiv, 1, pp. 72–89, 2 graphs, 1942.

Much of the information presented in this useful tabulated survey of the work in progress in the United States in connexion with breeding disease-resistant varieties of oats has already been noticed from other sources, but the following points may be mentioned. The annual losses from smuts (*Ustilago avenae* and *U. levis* [*U. kolleri*]), crown rust (*Puccinia coronata*), and stem rust (*P. graminis avenae*) over the period from 1919 to 1938 are computed in *Plant Dis. Reptr* at 40,000,000, 23,000,000, and 14,000,000 bush., respectively, but recent statistical studies [cf. *R.A.M.*, viii, p. 167; xx, p. 56] on the two rusts indicate that these estimates may be too low.

As regards the smuts, Victoria is highly resistant to all the known races and Markton and Navarro to all but certain rare ones, while Bond and Black Mesdag withstand the

disease adequately under most field conditions. Bond and Victoria are highly resistant to all the important races of *P. coronata*, and the moderate resistance of Rainbow, Alber, and Capa confers considerable protection on the crop in many sections. Richland, Iogold, and Rainbow are highly resistant to all the economically important races of *P. graminis avenae*, and the old White Tartar variety gives a satisfactory performance under certain field conditions; Jostrain (Joanette strain) is only moderately resistant.

By crossing within this group of varieties many new strains have been developed with resistance to one or more of the diseases under discussion. Thus, Marion C.I. 3247, Boone C.I. 3305, Tama C.I. 3502, and Vicland C.I. 3611 are resistant both to the smuts and rusts; Nakota C.I. 2883 (hull-less) and Hancock C.I. 3346 to the smuts and stem rust; and Fultex C.I. 3531, Ranger C.I. 3417, Rustler C.I. 3754, Rangler C.I. 3733, Letoria C.I. 3392, Lelina C.I. 3404, Lenoir C.I. 3393, Levic C.I. 3384, Lega C.I. 3379, De Sota C.I. 3923, Coker-Stanton C.I. 3855, Victorgrain C.I. 3692, and Fulgrain Strain 4 C.I. 3693 to the smuts and crown rust. New smut-resistant varieties include Carleton C.I. 2378, Bannock C.I. 2592, and Marida C.I. 2571.

GRIESBECK. **Zur Frage der Reichweite des Flugbrandes.** [A contribution to the question of the significance of loose smut.]—*Forschungsdienst*, xii, 2, pp. 226–227, 1941.

Loose smuts of barley [*Ustilago nuda*] and wheat [*U. tritici*] are stated to have been on the increase in many parts of Germany of recent years, both in summer and winter crops.

One objection frequently opposed to the systematic treatment of the seed-grain by the laborious hot-water method is that the loose smuts are merely blemishes without effect on the yield, but the writer cannot subscribe to this view. For example, 14 selected summer barley varieties tested in 1940 in the territories newly acquired by the Reich showed 11 to 970 diseased ears per sq. m., an incidence scarcely to be regarded as negligible.

HAENSELER (C. M.). **Helminthosporium leaf spot on Millet in New Jersey.**—*Plant Dis. Reptr*, xxv, 19, p. 486, 1941. [Mimeographed.]

Specimens of German millet (*Setaria italica*) showing severe leaf spot due to *Helminthosporium setariae* [the conidial stage of *Ophiobolus setariae*: *R.A.M.*, x, p. 232] were received from New Jersey in September, 1941. The disease appears to be of infrequent occurrence.

**Fungoid diseases of crops and their remedies.**—*Mysore agric. Cal., 1941–2*, pp. 38–42, 1941.

Popular notes are given on the incidence and control of a number of fungal diseases of Mysore crops. *Ganoderma lucidum* on areca palm and coco-nut trunks [*R.A.M.*, xiv, p. 693; xv, p. 436] may be combated by the destruction of infected material and fruit bodies of the fungus, prompt isolation of diseased trees, and the application of sulphur dust to the soil at the rate of ½ to 1 lb. per areca palm and 2 to 3 lb. per coco-nut.

BROWN (J. G.). **Wind dissemination of angular leaf spot of Cotton.**—*Phytopathology*, xxxii, 1, pp. 81–90, 2 figs., 1 diag., 1942.

In September, 1940, in southern Arizona, a 240-acre field of the SXP cotton variety, susceptible to black arm (*Phytomonas malvaceara*) [*Xanthomonas malvacearum*], raised from sulphuric acid-delinted and ceresan-dusted seed, contracted extensive and uniform infection by the black arm phase of angular leaf spot [*R.A.M.*, xx, p. 163], adjacent fields being proportionately less severely attacked. The most intensively infected field lay directly west of a half-section of land planted with untreated or 'fuzzy' seed, and adjoined on the west, without barrier, a similarly planted 80-acre

field. A field of cotton raised from treated seed, lying north of the above-mentioned half-section, contained more diseased plants on the side contiguous to the latter, while in a ranch to the south the only infected plants were situated on the side adjoining the half-section. Evidence was available to the effect that the cultivated cotton in the untreated fields constituted the sole source of inoculum, which was apparently conveyed to the treated cotton by a dust storm on 20th August [ibid., xv, p. 215], following injury to the plants by hail a week earlier. The heaviest infection reached the field on the west of the half-section raised from untreated seed, but the inoculum-bearing dust also spread laterally westwards in a fan-shaped belt in such a way as to involve bordering fields on the north and south, while at the same time infective material from the 80-acre field planted with untreated seed was also borne westwards.

Cotton fields serving as controls, situated at a distance of 12 miles from the infested areas and subjected to similar conditions, apart from the hail and dust storms, remained free from black arm.

*X. malvacearum* was isolated exclusively from untreated seed. The writer's studies were facilitated by absence from the crop of all seed-borne diseases other than black arm, and the virtual freedom of the fields from *Verticillium* [*albo-atrum*] and Texas root rot [*Phymatotrichum omnivorum*]. Part of the damage attributed by farmers to black arm, however, was really due to the air-borne *Alternaria* sp. [ibid., xxi, p. 14].

PRESLEY (J. T.). **Aecidium gossypii, the aecial stage of Puccinia boutelouae.**—*Phytopathology*, xxxii, 1, pp. 97–99, 1942.

Field observations in the late summer and autumn of 1940 in Arizona having indicated the possibility of a connexion between the uredo- and teleutospores of a rust tentatively determined as *Puccinia boutelouae* on the grasses *Bouteloua aristidoides* and *B. barbata* and the aecidia of *Aecidium gossypii* on cotton [*R.A.M.*, v, p. 82], cross-inoculation experiments were carried out in the laboratory at the University of Minnesota in the following spring with positive results on Acala cotton on the one hand and four species of *Bouteloua* (the two above-mentioned, *B. curtipendula*, and *B. gracilis*) on the other. A genetic connexion between the two stages may therefore be regarded as established. The question arises, however, whether *P. boutelouae* is identical with the morphologically very similar *P. vexans*, which are separated by Arthur [ibid., xiii, p. 728] on the basis of teleutospore pedicel length. The writer could find no justification for this distinction, and should further examination reveal the existence of only one species, the name *P. vexans* would take priority over *P. boutelouae*.

MÉTALNIKOV (S.). **Utilisation des microbes dans la lutte contre les insectes nuisibles.** [The utilization of microbes in the campaign against noxious pests.]—*C.R. Acad. Sci., Paris*, ccxiii, 16, pp. 533–535, 1941.

Details are given of further successful experiments in French, Swiss, and Algerian vineyards in the extermination of insect pests by means of treatment of the stocks with a solution of 'sporein' (pulverized spores of bacteria plus an adjuvant and an adhesive) [*R.A.M.*, xvii, p. 35]. This method results in substantial reductions (of the order of 90 per cent. and upwards) of the insect population of the vines, and is regarded by competent authorities in the canton of Geneva as destined to play an important part in viticultural practice.

McCOY (E. E.) & CARVER (C. W.). **A method for obtaining spores of the fungus Beauveria bassiana (Bals.) Vuill. in quantity.**—*J. N.Y. ent. Soc.*, xlix, 2, pp. 205–210, 1 fig., 1941.

A procedure is described for culturing large quantitites of spores of the entomogenous fungus *Beauveria bassiana*, recently shown by E. G. Rex (*J. N.Y. ent. Soc.*, xlviii, pp. 401–403, 1940) to infest adult Japanese beetles (*Popillia japonica*) [*R.A.M.*,

xx, p. 462]. The fungus is grown on autoclaved, moistened wheat bran, on which medium the spore yield is about 22 gm. per lb., the cultures being incubated at a temperature of 72° F. for 10 to 15 days; this is followed by several month's storage without injury. The separation of the spores from the bran may be effected by means of an ordinary flour sifter. For the collection of the spores in bulk an apparatus has been specifically devised in which compressed air under moderate pressure agitates the dried medium in a separatory funnel (of 500 ml. capacity) thereby detaching the spores and suspending them in an air stream turned on by means of a stopcock. This current escapes from the funnel mouth through a glass tube ending in a rubber attachment, and is conducted to a filter consisting of a disk of filter paper clamped between the two opposed rims of two aluminium pie dishes, each 23 cm. in diameter. With a filter area of about 300 sq. cm. about 10 gm. spores may be collected before opening the filter and scraping the paper, which may be used repeatedly.

Cavalcanti (A. P.). **Otomicose.** [Otomycosis.]—*Brasil-méd.*, lv, 43, pp. 726–729, 1941.

The writer briefly surveys the history, symptoms, etiology, and therapy of otomycosis in the light of the relevant literature and of his own experience in hospital and private practice at Botafogo, Brazil, where *Aspergillus niger* [*R.A.M.*, xx, p. 363] was isolated in one of the cases described from the aural canal of a 37-year-old woman.

Gonzalez Ochoa (A.). **Hallazgo del Fonsecaea pedrosoi var. cladosporioides en México.** [Detection of *Fonsecaea pedrosoi* var. *cladosporioides* in Mexico.]—*Rev. Inst. Salubr. Enferm. trop.*, ii, 2, pp. 187–192, 6 figs., 1941. [English summary.]

A cultural study of the fungus isolated by M. Baez from a localized verrucose lesion on the left foot of a Mexican halfbreed and tentatively referred to dermatitis verrucosa (*Rev. Inst. Salubr. Enferm. trop.*, i, 4, pp. 323–338, 1940) revealed its identity with *Fonsecaea pedrosoi* [*R.A.M.*, xix, p. 557] var. *cladosporioides* (syn. *Hormodendrum algeriensis* [ibid., vii, p. 639] and *Phialoconidiophora guggenheimia* [ibid., xvi, p. 812]). This is the first record of the fungus for Mexico [ibid., xx, p. 464].

Briceño-Iragorry (L.). **Nota acêrca de dos casos de tiña endotrix.** [Note on two cases of tinea endothrix.]—*Bol. Lab. clin. 'Luis Razetti'*, i, 3, pp. 65–67, 1 fig., 1941. [Abs. in *Trop. Dis. Bull.*, xxxix, 2, pp. 103–104, 1942.]

*Microsporum felineum* is stated to have been the parasite associated with tinea tonsurans in Venezuela prior to 1939, in which year, however, Dr. P. Guerra reported 11 cases of fungal infection, four caused by *Trichophyton sabouraudi*, six by varieties of *T. tonsurans* [*R.A.M.*, xvii, p. 819], better known as *T. crateriforme* [ibid., xvii, p. 818], and one by *T. rubrum*, the last-named responsible for Hebra's eczema marginatum.

Cultures on Sabouraud's medium from diverse types of lesions on the scalps of two children treated by the author in private practice in 1940 yielded two types of colony, one large, powdery, with a creamy-yellow centre, whiter towards the periphery, crateriform in the middle with radiating fissures, and the other fluffy and downy, white, and smoother than the foregoing. The powdery colonies gave rise to an abundance of conidia on simple or branched conidiophores, with very rare intercalary chlamydospores, and the smooth ones to fewer conidia, usually borne on simple, lateral or terminal conidiophores, and more chlamydospores. Both are referred to *T. tonsurans*, of which *T. crateriforme* is regarded by Carrión as merely a variant.

Dey (N. C.). **Trichophyton crateriforme in India.**—*Indian med. Gaz.*, lxxvi, 7, pp. 410–411, 1 pl., 1941.

Of 169 cases of ringworm of the scalp investigated at Calcutta, 72 were found to be of the endothrix *Trichophyton* type, 65 associated with *T. violaceum*, and 7 with *T.*

*crateriforme* [see preceding abstract], of which this is stated to be the first record for India. All the subjects were girls between the ages of 7 and 13 in an Anglo-Indian boarding school. The colonies of the fungus on Sabouraud's proof medium presented the powder-puff appearance described by Sabouraud, a crateriform depression later developing at the centre of the knob-like prominence in the middle, and the white, velvety surface turning brownish or yellowish-brown and powdery, with a hard, cartilaginous consistency. Aleuriospores were the only end-organs observed; they were either simple, sessile or short-stalked, produced laterally or terminally on the growing hyphae, or compound, forming clusters or 'thyrses'. Intercalary chlamydospores were also formed. Sugars were not fermented, there was no proteolysis in Löffler's medium or haemolysis in blood sugar, but the casein in milk was proteolysed. Guinea-pigs, rabbits, and mice reacted positively to inoculation with emulsions of pure cultures, the fungus being reisolated from the resultant typical lesions.

VAN PERNIS (P. A.), BENSON (MIRIAM E.), & HOLLINGER (P. H.). **Specific cutaneous reactions with histoplasmosis. Preliminary report of another case.**—*J. Amer. med. Ass.*, cxvii, 6, pp. 436–437, 1941.

Clinical details are given of a fatal case of histoplasmosis in a 63-year-old male patient at St. Luke's Hospital, Chicago, and of the cultural studies on the causal organism, *Histoplasma capsulatum* [*R.A.M.*, xxi, p. 79], which was isolated five months before death from a laryngeal ulcer and grown aerobically on blood (human and rabbit) agar and other media and under semi-anaerobic and anaerobic conditions on blood slants and in broth in two series, one maintained at 37° C. and the other at room temperature. Growth appeared on the plates of the former series in 72 hours and on those of the latter in five days, the colonies on dextrose agar being white and those on blood agar reddish-grey. Reaction to the Gram stain was negative. Round to slightly oval, lateral and terminal, thick-walled chlamydospores, 3·9 to 10 $\mu$ in diameter, were formed in six days and were shown to contain fat. A day later, ascus-like bodies developed, closely resembling the chlamydospores except in the presence of small nodules along their outer margins. The fungus did not ferment any of the sugars tested, litmus milk, peptone water (in which indol was produced), or acetyl-methyl carbinol. The organism was recovered from the internal organs of mice and guinea-pigs into which it was injected intraperitoneally in saline suspensions. Broth culture filtrates induced specific immediate and delayed reactions in the patient and in mice.

SCHOENKERMAN (B. B.). **Molds as a cause of seasonal allergy; spore count of Milwaukee.**—*Wis. med. J.*, xl, 9, pp. 797–799, 1 graph, 1941.

Moulds, among which *Alternaria* predominated, were shown by spore counts made from July to October, 1940, to constitute an important factor in atmospheric contamination at Milwaukee, Wisconsin, where a survey was made of the influence of these organisms on the development of allergic symptoms [*R.A.M.*, xxi, p. 16]. The peak number of roughly 190 per 1·8 sq. cm. was reached at the end of August, but as late as 7th October the spores were still present in sufficiently large numbers (60 per 1·8 sq. cm.) to induce severe cutaneous reactions.

HOOD (E. G.). **The value of mold and yeast control work.**—*Canad. Dairy Ice Cr. J.*, xx, 4, p. 29, 1941. [Abs. in *J. Dairy Sci.*, xxiv, 12, p. A 357, 1941.]

The principal sources of moulds [including *Oospora lactis*: *R.A.M.*, xxi, p. 79] in Canadian butter are stated to be inefficient pasteurization and raw cream contamination; dead ends in pipes; ineffectually cleaned vats, pumps, pipes, and churns, impure water and dirty holding tanks and ice; incorrectly treated parchment linings; the use of unseasoned timber for butter boxes and their storage in a damp place.

The Storch test is not, by itself, a sufficient indication of thorough pasteurization of cream, and requires to be supplemented by yeast and mould counts, on which

forecasts of the keeping quality of the butter can be based. Pasteurized butter should contain a total of less than 50 moulds and yeasts and 25,000 bacteria per gm. of butter where 'starters' are not used.

JOHNS (C. K.). **Controlling mold growth on Cheddar cheese.**—*Canad. Dairy Ice Cr. J.*, xx, 4, p. 36, 1941. [Abs. in *J. Dairy Sci.*, xxiv, 12, p. A 359, 1941.]

The condition of Cheddar cheese swabbed with 4 and 8 per cent. calcium propionate solutions [*R.A.M.*, xxi, p. 80] at the Central Experimental Farm, Ottawa, though not absolutely mould-free, was immensely superior to that of the untreated control samples, and no contamination developed in the presence of the same compound at a concentration of 12 per cent. Calcium propionate does not actually destroy the moulds but merely inhibits their growth. The immersion of the cheese in disinfectant solutions, though probably a more effective method of treatment, is attended by certain disadvantages.

TIMONIN (M. I.). **Microbial activity as influenced by root excretions.**—*Chron. bot.*, vi, 19–20, p. 440, 1941.

Chemical analyses of modified Crone's nutrient solutions in which flax plants of the Novelty and Bison varieties, susceptible and resistant, respectively, to wilt (*Fusarium*) [*lini*] had been grown for 27 days under aseptic conditions at the Division of Bacteriology, Ottawa, indicated that the former contained only a trace per plant of hydrocyanic acid per 450 ml. compared with 27 to 38 mg. in the latter. After the growth of the resistant Bison, the development of *F. culmorum* and *Helmintho-sporium sativum* was retarded by the solution, whereas that of *Trichoderma viride* was stimulated, the opposite being the case following the culture of the susceptible Novelty. The addition of glucose to the substratum accelerated the growth of all the fungi tested. It is apparent from these data that the minute quantity of hydrocyanic acid excreted or diffused through the root system of the wilt-resistant variety into the surrounding medium diversely influences the activity of the different groups of micro-organisms composing the rhizosphere [*R.A.M.*, xx, p. 29].

WATERHOUSE (W. L.) & WATSON (I. A.). **A note on determinations of physiological specialisation in Flax rust.**—*J. roy. Soc. N.S.W.*, lxxv, pp. 115–117, 1 pl., 1941.

Flax rust (*Melampsora lini*) is stated to cause substantial reductions in the seed harvest under epidemic conditions in Australia, while much lighter infections are responsible for severe damage to crops grown for fibre. In connexion with the breeding of varieties combining suitability for the latter purpose with resistance to rust, tests were carried out on 11 differential varieties with several isolates of the pathogen from diseased samples from New South Wales, Victoria, South Australia, and Tasmania, all of which were found to belong to one physiologic race. Six of the varieties were immune, viz., J.W.S., Abyssinian, Kenya, 'Very pale blue crimped', Ottawa 770 B, and Argentine, three resistant, Buda, Williston Golden, and Williston Brown, one semi-resistant, Akmolinsk, and one susceptible, Bombay. These results show that the race differs from those studied by Flor in North Dakota [*R.A.M.*, xix, p. 655], and confirmatory evidence of this was afforded by Bison C.I. No. 389 and Argentine C.I. No. 705–1, the former uniformly susceptible in the United States and the latter susceptible to all but one of 14 physiologic races, whereas in the authors' trials both these varieties were immune. From this evidence it is concluded that the Australian race of *M. lini* is distinct from any of those previously recorded.

**Borax prevents rust of Flax.**—*Plant Dis. Reptr*, xxv, 18, p. 459, 1941. [Mimeographed.]

According to a report by H. G. Hegeness, flax grown at the University of Minnesota Farm, planted in May, and treated with 60 lb. borax per acre remained free from rust [*Melampsora lini*: *R.A.M.*, xix, p. 655; xx, p. 294], though untreated plants, and

plants treated with calcium nitrate and zinc sulphate were heavily infected. The borax caused some leaf-burning, and it is thought that applications of 40 or 50 lb. per acre may be equally effective and at the same time harmless.

BAKER (K. F.) & TOMPKINS (C. M.). **A virosis-like injury of Snapdragon caused by feeding of the Peach aphid.**—*Phytopathology*, xxxii, 1, pp. 93–95, 1 fig., 1942.

*Antirrhinum majus*, *A. speciosum*, *A. nuttallianum*, *A. glandulosum*, *A. virga*, *A. molle*, and *Linaria dalmatica* seedlings and cuttings grown for experimental purposes under glass at Los Angeles, California, were observed in the spring of 1940 to show a virus-like injury of the terminal growth, which was subsequently noted also on outdoor and greenhouse plants in the San Francisco Bay area, and again in 1941 at Los Angeles. The most characteristic symptom consisted of a checking of the apical growth, each leaf rosette, viewed from above, showing a pale yellow to white centre with a green or green- and yellow-mottled periphery. The affected tips often turned brown and died, but in some cases growth was resumed or new lateral branches produced. The leaves were much stunted and often rolled, dorsally curled, and laterally distorted, the apical laminae sometimes bearing yellow or white spots, 1 mm. in diameter, mostly near the veins. In certain double-flowered varieties of *A. majus*, the basal foliage showed persistent, bright yellow, circular spots, up to 5 mm. in diameter.

The injury was found to be due to the feeding on the leaves of the peach aphid (*Myzus persicae*), the removal of which resulted in the production of entirely normal new foliage. Non-viruliferous insects maintained for many generations on turnip induced the same symptoms on *Antirrhinum* as those taken directly from infected plants of the latter. Attempts to transmit a virus from the affected plants to various plants susceptible to this type of disorder were unsuccessful.

KUNKEL (L. O.). **Heat cure of Aster yellows in Periwinkles.**—*Amer. J. Bot.*, xxviii, 9, pp. 761–769, 2 figs., 1941.

A preliminary test on the inactivation of the aster yellows virus [*R.A.M.*, xx, pp. 337, 590] in periwinkles (*Vinca rosea*) by heat treatment [cf. ibid., xvi, p. 678] demonstrated that hot-room treatment at 42° C. for one day rendered viruliferous aster leafhoppers [*Macrosteles divisus*] permanently non-infective, presumably freeing them from virus, and indicated that treatments at this temperature for a week or two might cure aster yellows in moderately large periwinkle plants.

To test this view, sets of two plants each were treated for 4, 5, 6, 7, and 14 days. All recovered, and produced apparently normal foliage. Symptoms reappeared after about three months in shoots near the ground in all plants except those treated for 14 days. These last showed no yellows during one year after treatment, and cuttings from them produced plants which remained free from symptoms during seven months' observations. Scions from each of the cured plants grafted on to healthy young periwinkles grew vigorously, and no disease symptoms were observed. An attempt to transmit the disease from the cured plants by means of aster leafhoppers gave negative results, though under the same experimental conditions transmission was obtained from affected asters and periwinkles. Experimental evidence further demonstrated that no attenuated strain of the virus was present in the cured plants.

Further hot-room experiments demonstrated that complete cure (tops and roots) resulted from 14 days' treatment at 38°, while six days' treatment at 36° sufficed to cure small branches. At the latter temperature eight days were required to inactivate all virus in the leafhoppers and 11 days to inactivate it in all the above-ground parts of the plants. Periwinkles could be reinfected and cured as often as desired; there was no evidence that cured plants were more resistant to attack than plants that had never been affected. Hot-water treatments gave the best results at 40°, at which temperature large plants survived for 24 hours, but the method could not be relied upon to

cure the condition in the roots. *Nicotiana rustica* plants affected with aster yellows (roots and top) were cured by hot-room treatment at 40° for three weeks.

Two patterns of recovery short of cure were observed in periwinkles. In one, all virus present in the above-ground parts, but not all that present in the roots, was inactivated. In the other, some virus remained in both tops and roots. The latter type of recovery was slight and transitory, but the favourable effects of the former persisted for many months.

The aster yellows virus would appear to be an entity that cannot exist for long at temperatures frequently reached in summer [in New Jersey]. It is able to spread only in summer and can exist for protracted periods only at rather low temperatures. Its rapid spread under favourable weather conditions shows that it is an efficient parasite. There is good evidence that the virus multiplies in the leafhoppers as well as in the plants, and that, in nature, it passes alternately from the one to the other. The cures obtained by heat inactivation of the virus in periwinkle plants, and its inactivation in leafhoppers show that, in respect of heat resistance, the aster yellows virus reacts independently of its hosts.

Hotson (H. H.). **The morphological distinction between Urocystis gladioli and Papulaspora gladioli.**— *Mycologia*, xxxiv, 1, pp. 52–58, 1 fig., 1 graph, 1942.

From a comparative study of *Urocystis gladioli* (using dried material from collections by G. H. Pethybridge in England, in 1923) and *Papulaspora gladioli* [*R.A.M.*, xx, p. 409] obtained in culture from B. O. Dodge and isolated from diseased gladiolus corms from Long Island, the author concludes that they are two distinct species, the former causing a serious smut of various *Gladiolus* spp. in Europe, but not reported from the United States, while the latter is saprophytic or only slightly parasitic on the same host in the United States. The main distinction consists in the different size of the spore balls, which measure 14 to 23 $\mu$ in diameter in *U. gladioli* and 24 to 64 (average 44) $\mu$ in *P. gladioli*; furthermore, in *U. gladioli* the single row of thin-walled cells is characteristic of the genus and the definite thickness of the wall of the inner cell is very distinct, whereas in *P. gladioli* the periphery is not always sterile and is more or less indefinite, being often composed of more than one layer of cells, indefinitely and irregularly arranged; finally there are 1 or 2 central cells in *U. gladioli*, while there are usually 2 to 6 or occasionally 6 to 8 in *P. gladioli*. For a diagnosis of *P. gladioli* which is labelled 'sp. nov.' and is not regarded as a synonym of *U. gladioli* (Req.) Smith, reference should be made to B. O. Dodge and T. Laskaris [loc. cit.], but it is pointed out in addition that the average diameter of the bulbils is 44 $\mu$ and that the bulbil primordium is a lateral branch, sometimes coiled in one plane, but never a spiral.

Parris (G. K.). **Eye-spot of Napier Grass in Hawaii, caused by Helminthosporium sacchari.**—*Phytopathology*, xxxii, 1, pp. 46–63, 5 figs., 1 graph, 1942.

Severe losses in the Hawaiian Napier grass (*Pennisetum purpureum*) plantings have occurred since the autumn of 1939 as a result of infection by *Helminthosporium sacchari* [*R.A.M.*, xxi, p. 21], sometimes necessitating the ploughing-up of entire stands as useless for fodder and replanting with other grasses. The oval or irregularly coalescent, reddish-brown, yellow-bordered lesions on the leaves measure 1 to 6 by 0·5 to 2 mm., and are very similar to those described by Voorhees [ibid., xvii, p. 754]. 'Runners' or streaks of dead tissue may extend from the primary lesion for several inches towards the leaf apex, causing little damage, while similar formations, unconnected with the fungal spots and accompanied by anthocyanin production, may appear on the foliage of plants with cankered stems, probably as a sequel to vascular disturbance. Old leaves of *P. purpureum* are more intensively attacked than young ones, the growing tip seldom being involved. Acute infection causes withering, desiccation, and premature death of the leaves in acropetal succession, finally leaving the

stem bare except for a tuft of three or four leaves. On the leaf sheaths the lesions are larger, paler, and more diffuse in outline than on the leaves. Lesions may develop on the stems from ground-level to several feet above the soil, but are usually found on the first 6 in., the nodes being more often involved than the internodes; smooth, regular, and reddish-brown at first, they later become sunken, irregular, and bluish-purple or black with greyish-white or reddish-brown margins. The diseased stems are shrunken, pithy, more or less hollow, with a partially or totally decayed interior. The crowns are seldom affected, but occasionally the basal buds are withered and discoloured and their subsequent growth stunted. From a distance, severely diseased Napier grass presents the appearance of having been struck by lightning or burnt by fire.

The taxonomy of the causal organism is fully discussed, and evidence adduced in favour of the retention of the name *H. sacchari* Butler, with its amplified description by Mitra [ibid., x, p. 759], as recommended by McRae [ibid., xiii, p. 12].

The physiological characters of eight isolates of the fungus from *P. purpureum* and one from sugar-cane were compared on various standard media. The Napier grass strain developed most luxuriantly at a temperature of 21° to 28° C. [ibid., v, p. 55 *et passim*]. Little or no difference in the appearance of isolates from the two hosts was observed on certain substrates, whereas on others the cane fungus resembled some Napier isolates but not others. Great variation in the growth of the Napier isolates occurred on certain media. The conidia of this strain were larger at 28° than at 21°, the reverse being the case with that from sugar-cane, except on standard nutrient agar, on which spore dimensions were little affected by changes of temperature.

The inoculation of healthy plants of *P. purpureum* with a strain of the fungus from the same host resulted in the development of typical eye spot symptoms, and the pathogen was reisolated from the diseased material. The Napier grass strain was only mildly injurious to sugar-cane and vice versa.

Eye spot of Napier grass may occur in a severe form at any time of year, unlike the corresponding disease of sugar-cane, which is most virulent during the winter months. Infection is favoured by dry conditions. The substitution of Merker grass, a variety of Napier, is recommended as a control measure.

CASS-SMITH (W. P.). **A note on the occurrence of grey mould or Botrytis rot of Apples.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xviii, 3, pp. 217–220, 2 figs., 1941.

At the end of March, 1941, specimens of Jonathan, Yates, Granny Smith, and Rokewood apples from the Mount Barker Co-operative Company were examined and found to be infected by *Botrytis cinerea*, only once previously reported (in 1932) as pathogenic to this host in Western Australia. Inoculation experiments showed the fungus to be mainly a wound parasite (only one successful infection on unwounded fruits), the conclusion likewise reached by G. H. Cunningham in New Zealand [*R.A.M.*, iv, p. 673; xix, p. 644], and the attack under observation was apparently favoured by abnormally heavy precipitation in the middle of March following a protracted drought, similar conditions having prevailed at the time of the earlier record.

ZELLER (S. M.) & EVANS (A. W.). **Transmission of western X-disease and marginal leaf spot of Peach in Oregon.**—*Plant Dis. Reptr*, xxv, 18, pp. 452–453, 1941. [Mimeographed.]

In transmission studies on 'X' disease of peaches [*R.A.M.*, xxi, p. 147], first recognized in eastern Oregon in 1939, but present in some parts of the State some years before, 31 peach seedlings grown from Lovell peach pits were budded with buds from diseased trees in eastern Oregon. The following spring 14 seedling trees were affected, and of these several were dead by August. Thirteen showed symptoms resembling those seen under field conditions, including longitudinal leaf roll and purplish-bordered areas which fell out. All 14 turned yellow early, and one showed flat, chlorotic leaves without leaf roll or purplish areas. As diseased buds from Oregon when budded into

seedlings in New York produced only this flat, yellow symptom, two distinct strains of the virus would appear to be present in Oregon. Some buds from affected bud sticks gave healthy growth when budded into seedlings.

Lovell seedlings budded with Rochester peach showing marginal leaf spot produced leaves which remained characteristically green, but had a few to many brownish or reddish, circular spots, particularly along the margins. In the Columbia River basin, eastern Oregon, these symptoms appear in June and during the rest of the season become progressively more severe. The spots drop out, leaving a ragged margin, and the leaves fall early. If any fruits develop, they ripen late and have hard, sound pits. There is no doubt that this is the condition described as 'group 3' by E. L. Reeves and L. M. Hutchins (Observations in the new so-called virus diseases of Peach trees. *Proc. 36th ann. Meet. Wash. St. hort. Ass.* [no date]). The marginal leaf spot symptoms were well developed 11 months after inoculation in both Lovell seedlings and Rochester trees.

When buds from red-leaved chokecherry [*Prunus* sp.], supposedly infected with the western type of X disease, were grafted into seedling peach, none of the chokecherry buds lived, but in six cases organic union was established between the chokecherry and peach tissues. In these six cases disease was transmitted, but the symptoms resembled those of marginal leaf spot. In the inoculated trees the spots took the form of circular, yellowish areas about 2 mm. in diameter, which turned purplish-red, and then became necrotic brown and dropped out, leaving a shot-hole effect along the margins. The central portions of the leaves remained dark green until late in the season. Further work is in progress to ascertain the relation of this marginal leaf spot to X disease.

HAHN (G. G.). **Field tests with a staminate clone of Alpine Currant immune from blister rust under greenhouse conditions.**—*Plant Dis. Reptr*, xxv, 19, pp. 476–478, 1941.

In the summer of 1940 plants of the staminate clone of Alpine currant (*Ribes alpinum*) previously found to be immune from *Cronartium ribicola* under greenhouse conditions [*R.A.M.*, xix, p. 158] were planted in the field in north-eastern Connecticut, together with plants of a susceptible pistillate clone, and the susceptible prickly gooseberry (*Ribes cynosbati*), the last-named being used to provide an indication of the presence of natural inoculum. One Alpine plant of each sex, together with one prickly gooseberry, was planted in dense shade on the bank of a stream, while two specimens of the pistillate clone and three of the staminate were planted with the prickly gooseberry in a cultivated vegetable garden fully exposed to the prevailing winds.

The four staminate plants of the clone previously reported as immune resisted infection, i.e., fertile fruiting bodies did not develop, and no necrotic foliar flecks [loc. cit.] were observed. The three pistillate plants all became infected. The plant growing in the shade produced small leaves of thin texture; under 10 per cent. of the total leaf surface was colonized by the rust. By August mostly teleutosori were found, which were snuff-brown, and longer and narrower than those produced on leaves in the open. Similarly, less necrosis of infected leaf occurred in association with teleutosori formation. The pistillate plants in the open were exceptionally robust, but about 50 per cent. of the total leaf surface showed infection. By August teleutosori were more numerous than on the pistillate plant of the same clone growing in the shade, and were shorter, broader, and walnut-brown. Old infection areas on leaves growing in full sunlight became necrotic.

The prickly gooseberry plants became infected in the shade and in the open, infection on the former site being less than on the latter.

These results confirm the earlier greenhouse tests in demonstrating that these pistillate plants of *R. alpinum* were susceptible to *C. ribicola* while the staminate ones were immune.

Hyde (W. C.). **Preservation of calico and hessian cloth when exposed to the weather.**—*N.Z. J. Agric.*, lxiii, 6, p. 504, 1941.

Satisfactory control of fungal deterioration in tent calico, chiefly due to *Cladosporium herbarum*, was obtained in co-operative experiments, organized by the Public Works Department and Plant Research Bureau, in the Waipoua Forest, Wellington, New Zealand, by one hour's immersion in shirlan WS, used at the rate of 1½ oz. per gal. water [*R.A.M.*, xvii, p. 524], which prevented the development of all but a trace of black spot at the end of a year's exposure to very exacting conditions involving heavy infection of the untreated controls in three or four months. The cost of the treatment ranged from 4*s*. to 9*s*. 6*d*. per tent, compared with 19*s*. 6*d*. for the other two effective preparations, iron chromium Nos. 1 and 2, which imparted brown and green tints, respectively, to the calico, interfering (especially the former) with light transmission.

Jute and cotton sandbags may be adequately protected against decay [cf. ibid., xxi, p. 214] and their service lives extended eightfold by immersion up to saturation point in 40 gals. Burgundy mixture (11½ lb. washing soda dissolved in 5 gals. water and stirred into a solution of 10 lb. copper sulphate in 30 gals. water), the cost of which does not exceed 0·1*d*. per bag.

Altergot (W. F.), Lavyghina (Mme K. S.), & Kuvshinova (Mme O. P.). **Destructive changes of the protoplasm in the course of lysis in the species Fusarium.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxxi, 3, pp. 286–289, 1 fig., 1941.

A microchemical study of lytic and non-lytic strains of several species of *Fusarium* (*F. niveum*, *F. lini*, *F. graminearum* [*Gibberella saubinetii*], and *F. solani*) conducted at the Saratov University, U.S.S.R., revealed a gradual disintegration of the cell nuclei of the fungi during the process of lysis, leading to a complete dissolution of the nuclear material in the protoplasm. This is accompanied by the disappearance of volutin granules and the accumulation of lipoid substances in the protoplasm of the cells of the fungi. It is suggested that the lytic factor, which accumulates during lysis and by its biological action approaches the group of bios substances, is also connected with compound protoplasmic complexes, and is liberated in their decomposition.

Brodie (H. J.) & Neufeld (C. C.). **The development and structure of the conidia of Erysiphe polygoni DC. and their germination at low humidity.**—*Canad. J. Res.*, Sect. C, xx, 1, pp. 41–61, 5 figs., 1942.

Following up the work of Yarwood [*R.A.M.*, xvi, p. 104] and of the senior author (1937, unpublished), germination studies with *Erysiphe polygoni* from knotweed (*Polygonum aviculare*) were conducted during 1939 and 1940 at the University of Manitoba, Canada, and the conidia of the fungus again found capable of germination, unlike other fungi, throughout a range of relative humidity from approximately zero to 100 per cent. The conidium of *E. polygoni* becomes cut off from the conidiophore by the deposition of a ring of wall material internally until a perforate disk is formed. Later the pore is closed and the mature conidium remains attached to its conidiophore by a papilla, until detached by shock, wind, or some other mechanical means. The conidia have never been observed to germinate *in situ*. The wall of the mature conidium appears to be relatively impervious to water and probably to gases except at the papillate end, through which stain has been shown to enter. The conidium is thus almost sealed against the ingress of oxygen from the outside and release of carbon dioxide from the inside, without which the germination process cannot take place. As an explanation of the mechanism of germination it is suggested that when the conidium is dislodged from its conidiophore, the end of the papilla becomes exposed to the surrounding air and, being more permeable than the remainder of the conidial wall, it allows carbon dioxide to pass out and oxygen to pass in, causing respiration and

other germination processes to begin. This suggestion was borne out by the results of experiments in which germination was checked in freshly detached conidia when they were held in an atmosphere containing 10 per cent. carbon dioxide, the same conidia germinating normally when removed from the carbon dioxide. Germination was similarly checked by holding the conidia in an atmosphere of nitrogen. The increase in volume that would seem necessarily to arise from the production of a germ-tube may conceivably result from the viscid protoplast being converted into materials more labile and voluminous, without the uptake of water being involved at all. Contrary to Yarwood's findings, the authors observed no shrinkage of the conidia during germination, but shrivelling and collapse took place when death was imminent. Quite regularly many conidia shrivel early in germination tests and it is thought that in such conidia the papilla does not function normally.

During the course of the experiments it was found that ordinary rubber tubing and rubber stoppers are extremely toxic to conidia of *E. polygoni*. Vulcanized rubber reduced germination from 41 per cent. in the control to 3·5 per cent., while non-vulcanized rubber reduced it from 57 to 37 per cent. In a further experiment as little as 0·01 gm. of vulcanized rubber per 100 c.cm. air was found to prevent mildew spores from germinating on dry slides in Petri dishes. It would appear that some compound of sulphur present in vulcanized rubber is responsible for its toxicity.

DYKSTRA (T. P.). **Potato diseases and their control.**—*Fmrs' Bull. U.S. Dep. Agric.* 1881, 65 pp., 50 figs., 1941.

This useful bulletin gives popular descriptions of potato diseases with a key for their identification, and discusses control measures, the development of disease-resistant varieties, storage, and seed certification. The losses due to potato diseases in the United States for the year 1938 are stated to have been estimated at one-sixth of the entire crop, representing a value of $35,000,000.

KRAMER (M.). **A 'perna preta' da Batatinha.** [Potato black leg.]—*Biológico*, vii, 12, pp. 350–353, 3 figs., 1941.

A popular account is given of the symptoms of potato black leg (*Erwinia phytophthora*), which has been reported from various parts of São Paulo, Brazil [*R.A.M.*, xvii, p. 57], and of the environmental factors affecting its development. Control measures should include storage of the tubers destined for planting in a dry, cool place; 1½ hours' immersion of the seed in 1 in 1,000 mercuric chloride; repeated inspections of the plots, especially those intended for the yield of seed, removing promptly all infected plants and setting aside any tubers fit for consumption, the diseased ones to be burnt; selection of elevated, well-drained sites for planting; quadrennial or quinquennial crop rotation, avoiding the alternation of potatoes with cucumber, tomato, broad bean, carrot, or radish, all of which have served as artificial hosts of the pathogen in inoculation experiments [ibid., xiii, p. 100]; and the use of thoroughly sound, certificated seed.

SNELL (K.). **New blight-resistant Potato varieties.**—*Int. Bull. Pl. Prot.*, xv, 11, p. 201M, 1941.

Three of the five new potato varieties, viz., Erika, Frühnudel, and Robusta, recently authorized for cultivation in Germany, are resistant to all physiologic races of potato blight (*Phytophthora infestans*), including the widespread biotype A [*R.A.M.*, xxi, p. 218]. Frühnudel is a yellow cooking variety, while the other two, with their high starch content, are suitable for industrial purposes. The varieties in question were derived from crosses between cultivated sorts and the 'W' forms of South American origin imported by the Biological Institute in 1912 and continuously improved since that date. In addition to resistance to late blight the primitive forms have conferred on the cultivated European varieties certain genes hitherto absent from the latter and

resulting in the production of heavy yields. With the development of the new varieties a problem occupying the attention of plant-breeders for nearly a century has in a large measure been solved.

TUCKER (J.). **Observations on Potato problems in the United States.**—*Amer. Potato J.*, xix, 1, pp. 1–6, 1942.

Among the problems confronting American potato-growers at the present time are those relating to tuber-indexing for the improvement and maintenance of quality in seed stocks, and the control of bacterial ring rot [*Bacterium sepedonicum*: *R.A.M.*, xxi, p. 95], which is stated to have spread far and wide throughout the country of recent years. A combination of the smear and ultra-violet light methods for the diagnosis of infection appears to be giving speedy and effective results in the hands of experienced operators.

The losses due to decay-producing organisms entering the tubers through injuries inflicted during washing and brushing, practices which are becoming more general, have been extremely small, but it is agreed that treated lots should be promptly marketed and consumed, and not held for storage purposes.

BRENTZEL (W. E.). **Treatment removes Rhizoctonia from Potato tubers.**—*Amer. Potato J.*, xix, 1, pp. 16–17, 1942.

The washing of potato tubers in preparation for the market [see preceding abstract] has created new problems in connexion with the spread of diseases, e.g., bacterial ring rot [*Bacterium sepedonicum*] and certain storage rots by means of the water. While testing a number of disinfectants for the prevention of this trouble, it was observed that the sclerotia of *Rhizoctonia* [*Corticium solani*] on tubers left in a solution of calcium hypochlorite for several hours were so extensively disintegrated as to be readily detachable by light brushing in water. At the same time, the outer rough surface of the tubers was slightly oxidized and bleached, the resultant fresh, pinkish colour resembling that of new potatoes. Good results were also obtained by immersion for 15 hours in a cold 5 per cent. solution of chlorinated lime, followed by light brushing, while in other tests satisfactory control was effected by six hours in a 10 per cent. solution and by one hour at a concentration of 5 per cent. at 100° F.

ELMER (O. H.). **Sterilization of Rhizoctonia sclerotia with corrosive sublimate.**—Abs. in *Phytopathology*, xxxii, 1, p. 3, 1942.

A momentary dip of seed potatoes infected by *Rhizoctonia* [*Corticium solani*] in acidulated mercuric chloride (3 in 500) was found to sterilize the adhering sclerotia more thoroughly than a ten-minute treatment in a 1 in 500 solution, the number of disease-free sprouts in 15 comparative tests since 1936 being 74·7 per cent. for the former and 64·2 per cent. for the latter method, the controls yielding only 7·3 per cent. healthy sprouts. The frequence of soil-borne infection by *C. solani* did not exceed 3·8 per cent. The death of the sclerotia resulting from momentary or ten-minute immersion evidently occurs after planting and not during the treatment. When sclerotia-covered tubers, after treatment by the momentary or ten-minute dips, were dried and cut in half, the half-tubers, held for 14 hours under running water to remove adhering mercuric chloride, developed sprouts with 89·1 and 91 per cent. infection, respectively, compared with only 28 and 41·5 per cent., respectively, for the unwashed halves. Effective control evidently necessitates a sufficient dosage of the chemical on the planted tubers, either applied momentarily at high concentrations or for a longer period at lower ones.

YOUNKIN (S. G.). **Weed suscepts of the Potato yellow dwarf virus.**—*Amer. Potato J.*, xix, 1, pp. 6–11, 1942.

Seedlings of 15 weeds exposed to infestation by the clover leafhopper (*Aceratagallia sanguinolenta*), the vector of the yellow dwarf virus of potato [*R.A.M.*, xx, p. 36],

under controlled conditions at Cornell University, Ithaca, New York, contracted the typical symptoms of the disease, including vein-clearing of the youngest leaves, followed by distortion, stiffening, and thickening, and failure of the petioles to elongate normally, so that a rosette of stunted foliage was formed round the crown of the plant. Later the affected leaves expanded, the petioles elongated to some extent, the veins turned pale green, and the leaves assumed an erect position, while the only sign of the disease in the foliage subsequently produced was its dark green coloration and upright habit. These symptoms were most pronounced in *Chrysanthemum leucanthemum* var. *pinnatifidum*, but similar features characterized the reactions of the following: *Tragopogon pratensis* (which was killed), *Rudbeckia hirta*, *Anthemis cotula*, *Galinsoga ciliata*, *Lepidium campestre*, *L. virginicum*, *Brassica nigra*, *Sisymbrium altissimum*, *Erysimum cheiranthoides*, *Verbascum thapsus* (still showing marked signs of yellow dwarf eight months after inoculation), *V. blattaria*, *Rumex crispus*, *R. obtusifolius*, and *Leonurus cardiaca*.

The presence of the virus was demonstrated in naturally diseased plants of *C. leucanthemum* var. *pinnatifidum*, red clover (*Trifolium pratense*), *Rudbeckia hirta*, and *Barbarea vulgaris*, and limited experimental evidence is presented indicating that the first-named may serve as a more important source of infection in the field than medium red clover (*T. medium*). Thus, the virus was transmitted from spontaneously infected *C. leucanthemum* var. *pinnatifidum* from a farm in Steuben County, New York, to 40 out of 48 *Nicotiana rustica* plants (83·3 per cent.), scions from which were grafted on healthy Green Mountain potatoes; six weeks later the latter showed typical yellow dwarf symptoms. Counts in three fields revealed 14·1, 30·6, and 27·7 per cent. infection, respectively, among the chrysanthemum population of each of 50 plots 1 sq. ft. in extent, while in the greenhouse (where the symptoms tend to disappear), 67·2 per cent. of the plants removed from an area of 4 sq. ft. in one of the fields gave a positive yellow dwarf reaction on *N. rustica*. Out of 627 red clover plants tested on the same host, only one was positive for the virus, and further tests likewise indicated the relative unimportance of this plant as a reservoir of infection.

HANSING (E. D.). **New suscepts of the yellow dwarf virus.**—Abs. in *Phytopathology*, xxxii, 1, p. 7, 1942.

The following plants, representing three different families, were found to harbour the potato yellow dwarf virus [see preceding and next abstracts] in New York State: *Kalanchoë daigremontiana*, *Barbarea vulgaris*, *Capsella bursa-pastoris*, and *Medicago lupulina*, the first-named being an exotic from Madagascar and the others fairly common native weeds. The Mammoth Red variety of red clover (*Trifolium pratense*) and the English and Kent Wild Whites (*T. repens*) have also been found to be susceptible.

HANSING (E. D.). **A study of the control of the yellow dwarf disease of Potatoes.**—Abs. in *Phytopathology*, xxxii, 1, p. 7, 1942.

In New York State the best control of potato yellow dwarf [see preceding abstracts] is secured by the use of varieties escaping the disease under conditions promoting moderate to extensive spread in the field, e.g., Arran Banner, Chippewa, Golden, Houma, Jubel, Katahdin, Sebago, and Warba, all of which contracted under 2 per cent. infection in replicated tests, compared with 2 to 11, 3 to 29, and 6 to 53 for Russet Burbank, Rural, and Green Mountain, respectively. The percentages of infection for 20 U.S.D.A. seedling varieties ranged from 0 to 72. Some reduction in the incidence of yellow dwarf was effected by attention to certain cultural factors, such as the location of the potato field, date of planting, the use of shielding crops, the roguing of current-season diseased plants, early harvesting, and the selection of seed potatoes from the middle of the field, as well as by dusting or spraying with pyrethrum, celite, sulphur, or Bordeaux mixture.

Clinch (Phyllis E. M.). **A strain of the tuber blotch virus causing top necrosis in Potato.**—*Sci. Proc. R. Dublin Soc.*, xxii, N.S., 46, pp. 435–445, 1 pl., 1941.

In further work at Glasnevin a second separation of the potato tuber blotch virus or virus F [*R.A.M.*, xvii, p. 832; xix, p. 162] from the X component was made by passage of interveinal mosaic through Arran Crest potato (which reacted with top necrosis). Core grafts of the necrotic Arran Crest tubers to healthy President yielded what appeared to be typical tuber blotch in that variety. Introduced to Irish Chieftain, however, the virus differed from that originally isolated by producing a lethal top necrosis. The units of the stock cultures of interveinal mosaic in President, from which the two isolations had been made, showed a corresponding difference in Irish Chieftain, though apparently identical in President. In the present paper the supposed complex is referred to as 'virulent tuber blotch', true tuber blotch being caused by virus F.

When virulent tuber blotch was introduced into different potato varieties by grafting, two main reactions occurred, a fatal top necrosis, and a slight yellow spotting at the distal end of the lower leaves. In all those varieties that showed the second type (14 out of 32), the effects were identical with those of virus F.

Virulent tuber blotch was readily transmitted by inoculation to *Capsicum annuum*, *Solanum nodiflorum*, *Nicotiana glutinosa*, *S. nigrum*, *Datura stramonium*, Kondine Red tomato, Rosy Morn petunia, and White Burley and Yellow Orinoco tobacco, the reactions produced being identical with those caused by virus F.

A study of the physical properties showed that no infections were obtained with sap from affected plants at temperatures over 62° C., that when crude sap, cleared by passing through compressed paper pulp, was filtered through L1, L3, and L5 Pasteur-Chamberland candles, some infection was obtained from the L1 line only, that crude sap stored at 16° to 18° became non-infective after three to four days, and that when crude sap was diluted with distilled water a dilution of 1 in 200 was the limit for infectivity. The physical properties of virulent tuber blotch virus were thus similar to those of virus F.

Other evidence demonstrated that the top necrosis element in virulent tuber blotch was unrelated to potato viruses B, C, or D, which also cause top necrosis. Thus, virus B passed freely through L3 and L5 filter candles, while the virus of virulent tuber blotch failed to do so. Virus B survived heating at 67°, while virulent tuber blotch virus was destroyed at temperatures over 60°. After five days at 20° a mixture of virulent tuber blotch sap and virus B sap caused 100 per cent. infection with virus B, while the virulent tuber blotch virus was destroyed. Virus B also failed to afford 'protection' against virulent tuber blotch in Up-to-Date potato plants. Virus C differs from virulent tuber blotch virus in that it produces top necrosis in President and Arran Banner potatoes, is not sap-transmissible, and appears to be restricted in its host range to potatoes. Virus D has been established as a strain of virus X, which differs fundamentally from virulent tuber blotch.

In insect transmission studies *Myzus persicae* failed to transmit any virus from President potatoes infected with virulent tuber blotch alone. In the presence of virus A, virulent tuber blotch, as such, was transmitted once.

Potato plants infected with virus F were immune from virulent tuber blotch. Virus G (aucuba mosaic) and virulent tuber blotch were also mutually protective.

It is concluded that virulent tuber blotch is caused by a strain of virus F, from which it arose spontaneously within the tissues of a potato plant. By its recognition Koch and Johnson's 'potato streak' virus [ibid., xiv, p. 525] is identified.

Granovsky (A. A.) & Peterson (A. M.). **Soil fauna in relation to the pit scab of Potatoes.**—Abs. in *Phytopathology*, xxxii, 1, pp. 6–7, 1942.

Studies of the relationship between soil microfauna and potato scab (*Actinomyces scabies*) [*R.A.M.*, xvii, p. 739] indicate that about half the fungal pits are free from

animal life, the remainder being infested by mites (viz., *Rhizoglyphus hyacinthi*, *R. phylloxerae*, and species of *Macrochelus*, *Cheyletus*, and Uropodidae, most of which are scavengers or of a predaceous habit), Annelid worms, and nematodes: *Pnyxia scabiei*, believed in some parts of the United States to be responsible for the disease, was detected in one sample only. The few maggots of Mycetophilidae observed in the pits belonged to *Sciara pauciseta*, *S. nitidicollis*, and species closely related to *Forcipomyia pilosa*. Several species of Sminthuridae, Isotomidae, and Entomobryidae were of fairly frequent occurrence. Scab is defined as resulting from the interaction of a physiologic race of *A. scabies* [ibid., xix, p. 725], secondary bacterial decay, and mycetophagous soil microfauna.

BORTELS (H.). **Die Bedeutung der Spurenelemente für Entstehung und Verhütung von Pflanzenkrankheiten.** [The significance of the trace elements in the origin and prevention of plant diseases.]—*NachrBl. dtsch. PflSchDienst*, xxi, pp. 69–72, 1941. [Abs. in *Chem. Zbl.*, cxiii (i), 4, p. 500, 1942.]

Reclamation disease [of cereals, chiefly oats, and other crops] is induced by a shortage of copper in the soil [*R.A.M.*, xxi, p. 134]. So far, Europe is free from zinc deficiency diseases. Heart and dry rot of sugar beets and 'glassiness' of fodder beets [ibid., xviii, p. 428] are stated to be curable by the application of molybdenum to the soil, and a scarcity of this element may be responsible for certain forms of legume 'sickness'. Cobalt and germanium are reputed to heal crown gall tumours [*Bacterium tumefaciens*], while resistance to mildews [Erysiphaceae] is enhanced by silicic acid [ibid., xix, p. 489]. On the other hand, certain disorders are attributable to an excess of chromium, arsenic, and selenium.

ABBOTT (E. V.) & INGRAM (J. W.). **Transmission of chlorotic streak of Sugar Cane by the leaf hopper Draeculacephala portola.**—*Phytopathology*, xxxii, 1, pp. 99–100, 1942.

Particulars are given of experiments at the Bureau of Plant Quarantine, United States Department of Agriculture, Houma, Louisiana, in which 490 healthy C.P. 29/320 sugar-cane plants (grown under cages in pots of steamed soil from cuttings immersed for 20 minutes in water at 52° C.) were exposed to infestation by the leafhopper *Draeculacephala portola* Ball from March to late May, 1941, allowing an average of five insects to feed on each plant. By 1st September 25 of the plants thus treated had developed the typical symptoms of chlorotic streak [*R.A.M.*, xx, p. 276], 20 being in cages containing both healthy and diseased plants and the remainder in those from which the infected plants had previously been removed. None of the controls, grown in proximity to diseased plants, but without the possibility of leafhopper intervention, contracted chlorotic streak. The results of these tests, though admittedly preliminary, are considered to afford evidence of the implication of *D. portola* in the transmission of the disease. The insect in question is stated to be the most abundant of all those attacking sugar-cane in Louisiana, with the exception of mealy bugs.

PINTO (M. C. DE R.). **V contribuicão para a flora criptogamica do norte de Portugal** [Contribution V to the cryptogamic flora of the north of Portugal.]—*Brotéria*, x, 4, pp. 161–167, 1941.

In this annotated list of 34 species of fungi collected in the north of Portugal are included *Stereum purpureum* on quince, *Merulius lacrymans* and *Paxillus acheruntius* on timber, *Phragmidium violaceum* in the uredo- and teleutospore stages on *Rubus* sp., *Venturia pirina* on pear, *Sphaerotheca pannosa* (in its conidial stage, *Oidium leucoconium*) on rose, and *O. quercinum* var. *gemmiparum* on oak.

SPARROW (F. K.) Jr. **A classification of aquatic Phycomycetes.**—*Mycologia*, xxxiv, 1, pp. 113–116, 1942.

This is an outline of a classification of the aquatic Phycomycetes based primarily on the structure of the zoospore and arranged in two series, (*a*) uniflagellate (consisting of the orders Chytridiales, Blastocladiales, and Monoblepharidales, which are believed to be closely related to each other) and (*b*) biflagellate (comprising the Plasmodiophorales, Saprolegniales, Leptomitales, Lagenidiales (formerly Ancylistales), and Peronosporales). In a footnote it is stated that Professor J. N. Crouch has suggested dividing the biflagellates into those with flagella of very unequal length (Plasmodiophorales) and those with equal or nearly equal flagella.

MIX (A. J.). **Errata in two recent papers on Taphrina.**—*Kans. Univ. Sci. Bull.*, xxvi, 6, pp. 355–356, 1939. [Received February, 1942.]

Errors and omissions in the author's two recent papers on the genus *Taphrina* [*R.A.M.*, xvii, p. 841] are given.

LOHWAG (K.). **Zur Anatomie des Deckgeflechtes der Polyporaceen.** [A contribution to the anatomy of the protective tissue of the Polyporaceae.]—*Ann. mycol., Berl.*, xxxviii, 5–6, pp. 401–452, 38 figs., 1940.

Detailed descriptions are given of the anatomy of the protective tissue of a number of Polyporaceae, including some responsible for the rotting of conifers and hardwoods in the Ostmark (Austria), e.g., *Ganoderma lucidum*, *G. applanatum*, *Fomes pinicola*, *Ungulina annosa* [*F. annosus*], *U. betulina* [*Polyporus betulinus*], *U. quercina* [*P. quercinus*], *Phellinus* [*F.*] *igniarius*, *F. robustus*, of which *P.* [*F.*] *hartigii* is regarded as a variant [*R.A.M.*, xvii, p. 358], *Xanthochrous* [*Polyporus*] *hispidus*, *Phaeolus* [*Polyporus*] *schweinitzii*, *Trametes cinnabarina*, *T. suaveolens*, *T.* [*Lenzites*] *trabea*, *T.* [*L.*] *gibbosa* [ibid., xviii, p. 719], *Daedalea quercina*, *L. betulina*, *Coriolus* [*Polystictus*] *versicolor*, *C.* [*D.*] *unicolor*, *C.* [*F.*] *connatus*, *C.* [*P.*] *hirsutus*, *Leptoporus* [*Polyporus*] *imberbis*, and *L.* [*P.*] *adustus*.

VOROBIEVA (Mme M. N.). **Proteolytic activity of a preparation from Tobacco mosaic virus.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxx, 5, pp. 466–467, 1941.

The results are given of an investigation on the effect of tobacco mosaic virus protein on seven-day-old tomato seedlings thoroughly ground up in a mortar and the destruction of the normal proteolytic enzymes then effected by boiling. By the addition to such preparations of tobacco mosaic protein (obtained by the method of Ryjkoff and Gromyko [*R.A.M.*, xvii, p. 708]) together with toluol as an antiseptic and following incubation at 32° C. for 106 hours, hydrolysis of protein took place, the degree of hydrolysis being greater when 0·31 per cent. potassium cyanide was present. It is suggested that this hydrolysis was effected by the virus protein itself or that there had been adsorption of proteolytic enzymes on the surface of the virus protein used.

MCKINNEY (H. H.). **Virus-antagonism tests and their limitations for establishing relationship between mutants, and non-relationship between distinct viruses.**—*Amer. J. Bot.*, xxviii, 9, pp. 770–778, 1941.

In virus antagonism studies [a preliminary account of which has been noticed in *R.A.M.*, xix, p. 556] tests were made with systemic against systemic viruses, in which young Wisconsin Havana Seed tobacco plants were inoculated with *Nicotiana* virus 1 (James Johnson's source), and then inoculated again, when mosaic symptoms had appeared, with a strain descended from the same virus.

The results showed that *N.* virus 1 rapidly and completely dominated all its primary and secondary mutants. Complete virus domination among the mutants occurred

quickly only among those that descended in direct line. Domination was slow to very slow when the mutants were selected from different lines of descent. The indication was that mutants from different lines of descent from a given virus may be found which differ in their ability to affect chlorophyll balance, but which are entirely compatible in a suitable host. Hosts may possibly be found in which a given virus may suppress an unrelated virus. The dominating virus was not in all cases that one of a pair which induced the weaker symptoms.

In tests on systemic viruses considered to be unrelated *N.* virus 1 and its mutant BSY were each combined with mosaic viruses of cucumber, celery, and potato, and *N.* virus 6. The data showed that symptoms alone cannot be used as a criterion for virus domination. The proof of virus domination evidently rests with suitable inoculation tests to determine the presence or absence of the virus that does not induce symptoms.

Studies were also made with hosts developing local, necrotic lesions when inoculated with certain viruses. When plants, with not fewer than seven leaves, of Maryland Medium Broadleaf tobacco and *N. sylvestris* showed typical mosaic the leaves were inoculated by wiping the upper surfaces with *N.* virus 6 or BSY (which induce lesions on these hosts). The results demonstrated that the virus-antagonism reaction is quantitative, i.e., it may be partial or complete, depending on the viruses, the nature of the test plant, the environment, and the method used. Strictly speaking, complete domination of one virus over another did not occur with the necrotic-lesion method, even in *N. sylvestris*. In a repeat experiment inoculation with a ring-spot virus [ibid., xix, p. 557] delayed the appearance of lesions by a yellow mosaic mutant, but the number was not reduced. Repeated tests with mosaic virus combinations have shown a reduction in number and a delayed appearance of the lesions. The data strongly suggested that virus antagonism involves many factors essentially similar to those obtaining in the phenomenon of aversion in fungi and bacteria. One virus may induce by-products antagonistic to another virus, or may make more efficient use of the virus-building materials supplied by the plant.

*N.* virus 6 and *N.* virus 1 should, it is claimed, be designated by separate numbers, as there is no evidence that either mutated from the other. *N.* virus 6 does not infect the tomato genotypes tested, and has a lower thermal inactivation point and smaller paracrystals than *N.* virus 1. For the present, *N.* virus 6 is regarded as ranking closer to *N.* virus 1 than to the other mosaic viruses studied.

From the results of this work with the virus-domination reaction and in view of the questionable status of the serological reaction, it appears that both reactions fail to meet the requirements necessary for proving natural relationships and non-relationships between the plant viruses on a comprehensive scale. Both reactions appear limited in their application to certain viruses and virus strains; and, with these, other reactions appear to be equally satisfactory for indicating natural relationships, and more satisfactory for establishing non-relationships. Both reactions, however, may serve to differentiate and identify viruses, without regard to virus genetics and phylogeny.

Braun (A. C.) & Elrod (R. P.). **Pseudomonas aeruginosa : plant pathogen.**—Abs. in *J. Bact.*, xliii, 1, pp. 40–41, 1942.

Five cultures of *Pseudomonas aeruginosa* obtained from human or animal sources produced severe leaf spot and necrosis of tobacco inoculated either by needle punctures or spraying, while destruction of the surrounding tissues, often accompanied by extensive wet rot, followed needle puncture inoculations into the stem. Koch's postulates were uniformly fulfilled in connexion with these tests. It is believed that several green-fluorescent bacteria which have been described as causing diseases of plants [e.g., tobacco wildfire: cf. *R.A.M.*, xix, p. 48] are identical with *P. aeruginosa.*

Walker (E. A.) & Wise (S. E.). **Anthracnose disease in Maryland Tobacco beds.**—*Plant Dis. Reptr*, xxv, 16, pp. 412–414, 1941. [Mimeographed.]

A peculiar leaf spot with an ashen-grey, papery appearance was observed in several localities of Maryland between 24th May and 28th July, 1941, on tobacco seedlings, the disease sometimes being so severe that small areas of the beds were brown with drying leaves and dead plants. The disease was seen to spread from the bottom leaves upwards. Isolations on 3 per cent. malt agar, consistently yielded a species of *Colletotrichum* with abundant pinkish conidia, 14 by 4 $\mu$, and numerous setae. Healthy Maryland strain 21 tobacco seedlings atomized with conidial suspensions from ten-day-old cultures developed the typical symptoms in 60 hours, and some were dead by the following day. Re-isolations from the diseased plants induced characteristic foliar and stem symptoms in a second series of inoculated seedlings, and positive results were further obtained on *Datura stramonium* and *Rumex crispus*. The exact identity of the fungus has not been determined. Previous records of a similar nature, all involving tobacco, include *C. nicotianae* from Brazil [*R.A.M.*, iii, p. 179], *C. tabacum* and *Gloeosporium nicotianae* from Germany [ibid., xi, p. 753; xii, p. 477], and *C. destructivum* from Kentucky [ibid., xiv, p. 85; xvi, p. 213].

The spots formed by the pathogen on the leaves are circular to irregular, sunken, greenish, water-soaked, later turning greyish-white, with a raised, brown margin, and measure $\frac{1}{8}$ to $\frac{1}{16}$ in. in diameter. On the midrib, lateral veins, and petioles the lesions are oblong, greenish-brown, and $\frac{1}{4}$ to $\frac{1}{2}$ in. long. The stems are also affected and break easily when pulled for transplanting. Few fructifications develop on the foliar lesions, but elsewhere they are formed in profusion.

Heuberger (J. W.) & Dimond (A. E.). **Relation of flea beetle control to control of Alternaria solani on Tomatoes.**—*Plant Dis. Reptr*, xxv, 16, pp. 415–418, 1941. [Mimeographed.]

In an experiment on tomatoes to test the value of copper compounds against early blight (*Alternaria solani*) [*R.A.M.*, xx, p. 450], the addition of derris dust to tribasic copper sulphate, copper oxychloride, yellow cuprous oxide, red cuprous oxide dust (containing 7 per cent. metallic copper plus derris to give 0·75 per cent. rotenone content), and Bordeaux mixture (all the sprays at the rate of 1·5 lb. metallic copper per 100 gals. and derris at that of 4 lb.), reduced the total number of spots on the seventh leaf of each of the nine test plants on 28th July from 257, 251, 201, 190, and 108 to 72, 115, 49, 91, and 76, respectively, and on the tenth leaf of eight plants on 8th August from 320, 315, 254, 295, and 63 to 69, 111, 57, 105, and 36, respectively, the unsprayed controls bearing 327 and 1,010 spots, respectively. The improvement in control appears to be related in some way to the control of flea beetles (*Epitrix cucumeris*).

Thomas (W.) & Mack (W. B.). **A foliar diagnosis study of the nutrition of greenhouse Tomatoes in relation to the incidence of a disease.**—*Bull. Pa agric. Exp. Sta.* 405, 17 pp., 3 graphs, 1941.

In a study at the Pennsylvania Agricultural Experiment Station of the nutrition of greenhouse tomatoes in relation to the incidence of a disease with symptoms of *Fusarium* [*bulbigenum* var.] *lycopersici*, the method of foliar diagnosis was applied (*J. agric. Res.*, lx, pp. 811–832, 1940), involving a comparison of the intensity of nutrition and equilibrium conditions between the dominant nutritive elements in morphologically homologous leaves of diseased and healthy plants.

The plants grown in plots receiving different combinations of fertilizers containing nitrate, phosphate, and potash, without manure showed more or less marked symptoms of disease, whereas plants receiving manure in addition to fertilizers did not become diseased. The diseased plants were divided into three lots, (1) severely

infected, (2) with mild symptoms, and (3) showing no external sign of infection by 10th June. The intensity of nutrition, i.e., the sum of the percentages of the plastic elements (nitrogen, phosphoric acid, and potash) in the leaves, was calculated to be uniformly less in the foliage from all three types of diseased plants than in that of healthy ones. The lower the intensity of nutrition, moreover, the heavier was the attack of the pathogen. Qualitatively, however, considerable differences existed in the nutrition of the plants on the diseased plots. The relationships between the plastic elements and between the bases lime, magnesia, and potash are shown in trilinear co-ordinates [loc. cit.] for the composition of the nitrogen, phosphorus, and potassium units and the calcium, magnesium, and potassium units in the 16th leaf. The results indicate higher values for nitrogen and lower values for phosphorus and potassium in the leaves of diseased plants from diseased plots treated with potash and superphosphate with and without sodium nitrate than in leaves of plants from healthy plots receiving the complete fertilizer plus manure. In another diseased plot, receiving only sodium nitrate and superphosphate, lower values for nitrogen and potash, but higher for phosphoric acid, obtained in leaves from diseased plants compared with the leaves of healthy plants from the plot treated with fertilizer plus manure. Leaves from badly diseased plants of the plot receiving all elements without manure showed a progressive decrease in the calcium of the calcium-magnesium-potassium unit.

The results indicate that susceptibility is related to the mode of nutrition, and the earliest date at which disequilibrium is recognizable is 27 days after the plants are set in the beds.

Campbell (W. A.) & Davidson (R. W.). **A species of Poria causing rot and cankers of Hickory and Oak.**—*Mycologia*, xxxiv, 1, pp. 17–26, 3 figs., 1942.

A fungus causing a white rot and cankers of living hickory (*Hicoria glabra* and *H. ovata*) and several oak species in Pennsylvania, Delaware, Virginia, and North Carolina is described as a new species, *Poria spiculosa*. On hickory the cankers, which usually develop around a branch wound, most commonly resemble a nearly healed, swollen wound with protruding callus, or are prominent burl-like bodies with several vertical or irregular folds in the callus, sterile fungus material being always present in these cankers. Occasionally open cankers with a depressed centre and a prominent callus ridge are formed. A slightly protruding core of fungus material resembling the remains of a stub, which cannot properly be called canker, may be produced in the early stages of infection, probably developing later on into the typical canker. At the back of the cankers a yellow or brown mycelial plug is formed which extends some distance into the rotted wood. The rot is soft and white or slightly yellowish at first, later becoming powdery and dry. On oak the canker formation appears to be less frequent, the most common form being the inconspicuous protrusion of sterile fungus material closely resembling a branch stub. A cut through such a branch scar reveals an outer hardened fungus crust of the same colour as the bark and a softer mycelial plug which fills the cavity of the branch stub. Open cankers and burl-like bodies are also occasionally found. The rot is confined to the heartwood and is typically soft, white, and spongy, all evidence indicating that branch stubs are the usual infection points. Recent observations based on external evidence of decay seem to point to *P. spiculosa* as being one of the more important causes of decay in Atlantic coastal areas on such species of oak as *Quercus nigra*, *Q. phellos*, and *Q. rubra*, occurring less frequently in the mountain regions. The perennial sporophores of the fungus are encountered effused in patches or in a continuous mass up to 1·5 m. in length on the bark or decorticated surface of thoroughly decayed logs and snags and occasionally on the dead tops of living trees. The pore surface is brown, whitish or greyish with age, smooth when young, becoming checked and cracked with drying; the tubes 2 to

5 mm. long; the subiculum thin, usually less than 0·5 mm. thick; and the pores 6 to 8 per mm. Setae are unevenly distributed; they are bulbous at the base, not projecting strongly, 10 to 20 by 5 to 8 $\mu$. The spores are hyaline, globose or subglobose, 3·5 to 4·5 $\mu$ in diameter; in the subiculum setae-bearing hyphae are occasionally found with sharp-pointed, short side branches.

In culture the fungus forms in 14 days an appressed, very tough, leathery, yellowish mat, 5 to 7 cm. in diameter, usually azonate, but occasionally somewhat zoned, with a woolly or finely nodulose surface and a white margin. It is closely related to *Fomes igniarius* var. *laevigatus* [*R.A.M.*, xx, p. 503] and *P. prunicola*, but can be easily separated from them in culture, as the former of these two fungi grows faster and lacks the setae-bearing hyphae, and the latter produces a softer, raised spongy mat, very distinct from that of *P. spiculosa*. From all other brown Polypores studied to date the new fungus can be separated by the setae-bearing hyphae.

Campbell (W. G.). **The relationship between nitrogen metabolism and the duration of the larval stage of the death-watch beetle (Xestobium rufovillosum de G.) reared in wood decayed by fungi.**—*Bio-chem. J.*, xxxv, 10–11, pp. 1200–1208, 3 graphs, 1941.

Nitrogen estimations were carried out on a series of samples of oak sapwood decayed to various stages by *Phellinus cryptarum* [*R.A.M.*, xx, p. 141], which was shown to remove a considerable proportion of the element, much of it being transferred to the mycelium growing on the exterior of the test pieces. After the removal from the latter of the external mycelium, the dead wood, which had lost some 50 per cent. of its initial weight through decay, was found to contain significantly more nitrogen (e.g., 10 per cent.) than sound wood of similar origin. The nitrogen content of the frass of *Xestobium rufovillosum* reared in oak sapwood rotted by *P. cryptarum* was compared in three separate instances with that of the original decayed wood, and no significant differences were found between the two quantities. It is concluded that the growing larva retains in its body a minimum of 95 per cent. of the nitrogen available to it in the wood. The nitrogen in decayed, as opposed to relatively or completely sound, wood is made more accessible to the death watch beetle larvae by the softening effect of the fungus on the substratum. Less resistance is thereby encountered to boring, and the duration of the larval stage is correspondingly decreased.

Thompson (Edna O.). **Morphological differences in Taphrina coerulescens upon different species of Quercus.**—*Kans. Univ. Sci. Bull.*, xxvi, 6, pp. 357–366, 2 pl., 1939. [Received February, 1942.]

An examination of the asci of *Taphrina coerulescens* on various species of oak [*R.A.M.*, xxi, p. 232] showed the dimensional range to extend from 30 to 120 $\mu$ in length and 11 to 34 $\mu$ in width instead of from 40 to 80 by 15 to 25 $\mu$, as hitherto reported in the literature. The largest asci were found on *Quercus geminata*, *Q. coccinea*, and *Q. douglasii*, and the smallest on *Q. cerris*, *Q. macrocarpa*, and *Q. undulata*. The shape of the asci was also found to vary according to the host. Commonly their bases are gradually tapered and thus wedged closely between adjacent epidermal cells of the host, but the asci formed on *Q. kelloggii* or *Q. alba* are blunt or slightly rounded at the base, while those on *Q. borealis* and *Q. cerris*, for instance, are often furnished with rhizoidal elongations which may clasp the host cells. Observations have been made in Kansas pointing to the existence of physiologic specialization in *T. coerulescens*, but further studies are necessary to determine the extent of this phenomenon.

From an examination of type material of *T. rubrobrunnea* (Pk) Sacc. the author concludes it is a synonym of *T. coerulescens*. On the other hand, *T. kruchii* [ibid.,

xvi, p. 563] on *Q. ilex* should be maintained as a distinct species, on account of its capacity to induce the formation of witches' brooms on its host.

CARTER (J. C.). **Preliminary investigations of Oak diseases in Illinois.**—*Bull. Ill. nat. Hist. Surv.*, xxi, 6, pp. 195–230, 52 figs., 1941.

Numerous fungi, of which 22 are described in this paper (supplemented by a three-page bibliography), were found to be associated with cankers, deep wood infections, die-back, and twig blight of oaks (*Quercus* spp.) in nursery, shade, and ornamental plantings and native stands in Illinois [*R.A.M.*, xx, p. 183]. The organisms most consistently isolated from cankered trees were *Dothiorella quercina*, *Coryneum kunzei*, *Cytospora* (*Valsa*) *intermedia*, *Nummularia clypeus*, *Diatrype stigma*, *Phomopsis quercina*, *Phoma aposphaerioides*, *P. quercina*, *Fusicoccum ellisianum*, *Sphaeropsis quercinum*, and *Bulgaria inquinans*, while die-back was specifically attributable to *Coniothyrium truncisedum* and *Pyrenochaeta minuta* n.sp. *Armillaria* was prevalent as a cause of root rot; *Cylindrosporium quercinum* n.sp. was found fruiting in the diseased tissues of one specimen of *Q. imbricaria* suffering from die-back; *Rhodosticta quercina* n.sp. was observed causing a similar trouble in a single specimen of *Q. palustris*; an unidentified species of *Cephalosporium*, characterized by capitate, hyaline, ellipsoid to ovoid, sessile conidia, 2 to 3 by 1·5 to 2 to 7·5 to 10 by 3 to 3·5 (mean 3 to 4 by 1·5 to 2) $\mu$, borne on simple, hyaline, filiform conidiophores, 250 to 300 by 2 to 3 $\mu$, was obtained in pure culture from 27 specimens of *Q. alba*, *Q. velutina*, *Q. imbricaria*, and *Q. borealis maxima*; *Nigrospora spherica* (previously observed by H. A. Harris on elm [ibid., xii, p. 125]) caused twig blight of *Q. stellata* and *Q. palustris*; a species of *Cunninghamella* isolated (apparently for the first time in the case of oak) from die-back of *Q. borealis maxima*, formed on maize meal agar tan, straight or curved, conidiophores, 75 to 300 by 4 to 6 $\mu$, on which are borne tan, globose, echinulate conidia, 2·9 to 3·3 $\mu$ in diameter; *Pestalozzia clavispora* was the agent of leaf and petiole blight of *Q. velutina*; *Chaetomium globosum* [ibid., xxi, p. 89] was isolated from the discoloured live wood of *Q. alba*; an *Alternaria* with dark brown to nearly black conidia, 9 to 46 by 6 to 12 (21 by 9) $\mu$, with 1 to 6, usually 3 to 4, transverse, and up to 3 longitudinal, septa, was frequently obtained from the diseased bark and occasionally from the blighted petioles of various species of oak, and in one instance (*Q. alba*) from the live wood, in association with *N. clypeus* canker; and a *Penicillium*, with ovoid to globose, hyaline, catenulate conidia, 4·4 to 4·8 by 3·4 to 3·8 $\mu$, was isolated from living wood of *Q. borealis maxima* and *Q. alba* showing dark brown to black streaks, and from dead wood adjoining the living portion in a single case of die-back of *Q. borealis maxima* (in conjunction with *Cytospora intermedia*), other associated species being *Cephalosporium* (in *Q. borealis maxima*), *D. quercina* (in *Q. alba*), and *Phoma* in an unidentified *Q.* sp.

*Pyrenochaeta minuta* produces in culture a light to dark brown mycelium, with sparse, grey to light brown aerial, and abundant light to dark brown surface hyphae; scattered, globose to ovoid, sooty brown to black pycnidia, 60 to 535, mostly 60 to 100 $\mu$ in diameter, with round ostioles, 8 to 10 $\mu$ in diameter; brown, septate, straight to curved setae, tapering towards the apex, 10 to 50 by 2 to 4 $\mu$; and hyaline, fusiform, continuous, ovoid to ellipsoid conidia, 1·5 to 4 by 0·7 to 3 $\mu$.

*Cylindrosporium quercinum* is characterized by dark brown to black, pulvinate, innate, later erumpent acervuli, 530 to 1,100 $\mu$ in diameter, 130 to 400 $\mu$ in height, inhabiting an elongated, light to dark brown, diseased region of the branch, and by hyaline, acicular, continuous to uniseptate, straight or slightly curved conidia, 20 to 40 by 1 to 3 $\mu$.

*R. quercina* produces on a light to dark brown, discoloured area of the branch, red, tubercular, not crustose stromata, 1,200 to 1,500 $\mu$ in diameter, 800 to 1,000 $\mu$ in height; ovoid to irregular, immersed pycnidia, 60 to 180 by 25 to 85 $\mu$; and hyaline to subhyaline, ovoid to ellipsoid conidia, 2·8 to 3·5 by 1 to 2 $\mu$.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
OF
# APPLIED MYCOLOGY

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Kawamura (E.). **Studies on the sex of Hymenomycetous fungi.**—*Bult. sci. Fak. Terk. Kjuŝu Univ.*, ix, 3, pp. 337–382, 10 figs., 3 diags., 1941. [Japanese, with English summary.]

The basidiospores of *Pleurotus ostreatus* and *Polystictus sanguineus* [*R.A.M.*, xviii, pp. 4, 221] were found to be uninucleate, their monosporous mycelia being devoid of clamp-connexions and branching at a wide angle. The pairing of compatible monosporous mycelia results in a diploid mycelium furnished with binucleate clamp-connexions and branching at a narrow angle. Fruit bodies were produced exclusively from the secondary bisporous mycelia, indicating that the species under observation are heterothallic. Mating experiments [the results of which are discussed in detail] showed both fungi to be tetrapolar.

*P. sanguineus* forms oidia on either primary or secondary mycelia, those produced on the former being uninucleate and giving rise to uninucleate mycelia, whereas those developing on the latter are binucleate and produce binucleate mycelia. Some monosporous mycelia cultured from a wild fruit body of *P. sanguineus* were of a light buff colour in contrast to the normal pink.

Buchanan (W. D.) & May (C.). **Technique for artificially feeding Scolytus multistriatus and Saperda tridentata spores of Ceratostomella ulmi and other substances.** —*Phytopathology*, xxxii, 1, pp. 95–97, 1 fig., 1942.

Particulars are given of a method of artificially feeding the bark beetles *Scolytus multistriatus*, *S. sulcatus*, and *Saperda tridentata* with coremia and spore suspensions of *Ceratostomella ulmi*, with and without the admixture of finely ground elm bark, under conditions precluding the external transfer of the fungus from the mouth parts to the posterior portion of the body [*R.A.M.*, xx, p. 608].

Davis (S. H.) & Harry (J. B.). **A Xylaria pathogenic to Ginkgo biloba L. seeds.**—*Phytopathology*, xxxii, 1, pp. 91–93, 2 figs., 1942.

A species of *Xylaria*, tentatively identified as *X. longeana* Rhem, was isolated in the summer of 1938 from dying and dead branches of a staminate specimen of *Ginkgo biloba* at the Morris Arboretum, Philadelphia. In April, 1939 and 1940, seeds collected in the preceding autumn and stored over winter at 40° F. were planted in pots in clay loam soil with which was incorporated inoculum of the fungus from cultures on steam-sterilized wheat. In the first series of tests, the percentage of germination was reduced by the pathogen from 32 to 2 and in the second from 55·4 to 2·5, such seedlings as did emerge being severely stunted while the non-germinating seeds and non-emergent seedlings were covered with thick, black mycelial masses resembling stromata. Removal of these from the stony layer of the seed revealed black lines extending through the stony stratum into the papery layer of the testa. The causal organism was reisolated from the diseased material.

Plakidas (A. G.). **Venturia acerina, the perfect stage of Cladosporium humile.**—*Mycologia*, xxxiv, 1, pp. 27–37, 3 figs., 1942.

An investigation of the leaf spot disease of red maple (*Acer rubrum*) observed near Ithaca, New York State, and also near Millinocket, Maine, in 1940, proved it to be identical with that observed by J. J. Davis in 1919 in Wisconsin and attributed to *Cladosporium humile* [*Trans. Wis. Acad. Sci.*, xix, p. 702, 1919]. The spots produced by this disease are numerous, varying in size from 0·5 to 20 mm. When young, the spots are small, black, round to angular, with a pale green halo; when older, angular to suborbicular, with irregular margins surrounded by a pale green halo, and zonate. The spots sometimes coalesce, forming very large irregular necrotic areas. The upper surface of the spots is dark reddish-brown, the lower lead-grey, both being covered by a light brown, septate mycelium from which arise short, brown conidiophores bearing oblong to fusoid-cylindrical, catenulate, unicellular to uniseptate, olive-brown conidia. Most conidiophores arise singly as lateral branches of the surface mycelium, but some arise in fascicles from a more or less tuberculate stroma.

Perithecia of an ascigerous form of the fungus, for which the name *Venturia acerina* is proposed, were found on overwintered maple leaves. Cultures obtained from single asci or ascospores all yielded conidia identical with those of *C. humile* cultured from diseased leaf tissue or from single conidia. The perithecia were scattered or gregarious, mostly erumpent, occasionally superficial, membranous, dark, globose to beaked, typically beset with stiff, dark brown, non-septate bristles in the region of the apex and with hyaline to light brown, septate hairs below, 72 to 165 by 82 to 191 (average 106·3 by 132·0) $\mu$, the asci sessile, obclavate at first with the spores imperfectly biseriate, becoming longer and cylindrical at maturity with the spores obliquely monostichous, 62·7 to 72·6 by 8·3 to 10 (66·7 by 9·7) $\mu$, with paraphysoids, but no paraphyses; and the ascospores oblong-elliptical, 12·5 to 14·8 by 4·3 to 5 (13·8 by 4·8) $\mu$. An expanded description is also given of the conidial stage, *C. humile.*

With one exception, the results of all artificial inoculations were either entirely negative or slight infection only resulted. It is believed that the age of the leaf may influence its susceptibility. The fungus was found to overwinter on the leaf either in the mycelial stage, producing conidia in the spring, or in the perfect stage as perithecia.

Pirone (P. P.) & Bender (T. R.). **Bleeding necrosis of Sweet Gum.**—*Plant Dis. Reptr*, xxv, 18, p. 458, 1941. [Mimeographed.]

Sweet gums (*Liquidambar styraciflua*) growing at Roselle and Moorestown, New Jersey, and at Brighton and Great Kills, Staten Island, New York, show profuse bark-bleeding, usually at or a few feet above ground-level, but sometimes at a height of 20 ft. from the ground. Usually, only one or two areas on any trunk show the condition, but occasionally there may be twelve distinctly separate areas presenting the symptom. The inner bark under the ooze is dark reddish-brown, with an occasional pocket containing a white, crystalline-like solid. In advanced stages three or four rings of the sapwood are also discoloured. Upper portions of an affected tree may slowly succumb through the season, or the whole top may quickly perish. A fungus tentatively identified as *Dothiorella berengeriana* or as a closely related species was consistently isolated. Inoculation tests resulted in characteristic discoloration, but have not, so far, given rise to bleeding.

Holzer (W. F.). **Effects of heartwood decay in Western Hemlock on sulphite pulps.**—*Paper Tr. J.*, cxii, 19, pp. 38–40, 1 fig., 1941.

Three samples of western hemlock (*Tsuga heterophylla*) heartwood from Washington virgin forests, representing three conditions, viz., sound, medium decay, and advanced decay, were cooked by a normal, calcium-base sulphite cook for a total period of nine hours, during the first 4½ of which the temperature rose to 275° F. and was subsequently

maintained thereat. The density of the wood was found to decrease with decay, but the yield per lb. of dry substance remained constant. The chlorine demand of the pulp for bleaching increased with decay, in an advanced stage of which its colour resembled that of unbleached kraft. Physical and chemical analyses of the pulps revealed definite evidence of degradation consequent on decay, but the deterioration of the fibre from this cause was less than might have been expected. Since the reaction, as judged by decrease in base in the cooking liquor, apparently proceeded at a uniform rate irrespective of decay, the reduction in the rate of pulping, gauged by bleachability and lignin content, is presumably due to a decreased solubility of lignin. Attention is drawn to the similarity of the effects on wood of decay and acid degradation.

BOYCE (J. S.). **Exotic trees and disease.**—*J. For.*, xxxix, 11, pp. 907–913, 1941.

The writer has assembled much valuable and interesting information, already noticed in part in this *Review*, on the reaction to disease of exotic trees, citing some striking examples of their destruction by the fungal and insect parasites indigenous to the new habitat or coming from the native home and developing with increased virulence in their new surroundings. The same considerations apply in a somewhat lesser degree to attempts at the extension of a native species beyond its normal range. In Europe, where there are comparatively few valuable native timbers, especially among the conifers, some justification may be found for the introduction of foreign species, but this certainly does not hold good for North America, with its wealth of different varieties. Unless the exotics meet some definite requirement that cannot be fulfilled by trees of native origin, their importation into the already amply-stocked North American continent cannot be warranted.

HULBARY (R. L.). **A needle blight of Austrian Pine.**—*Bull. Ill. nat. Hist. Surv.*, xxi, 7, pp. 231–236, 4 figs., 1941.

Blighted Austrian pine (*Pinus nigra* var. *austriaca*) needles collected in northern Illinois in the autumn of 1938 were wintered out-of-doors and examined periodically. The immature stromata near the bases remained quiescent until the very early spring, when they began to develop into strongly erumpent, loaf-shaped structures; by mid-April pycnidial locules were becoming differentiated, and a month later conidia were in course of production. The distinctive Dothideaceous structure of the stroma relates the fungus under observation to certain genera in the scolecosporous division of the Phomaceae, e.g., *Hemidothis* Sydow and *Septocyta* Petrak, but various points of difference necessitate the erection of a new genus, *Dothistroma*, for the needle blight organism, which is named *D. pini* and designated the type species of the genus. The dull dark brown stromata measure 125 to 1,500 $\mu$ in length, 50 to 450 $\mu$ in width, and up to 600 $\mu$ in height. The hyaline, scoleciform conidia are straight or slightly curved, 1- to 5-, usually 3-septate, 16·5 to 29 by 3·5 $\mu$, and are borne on hyaline or amber, simple conidiophores of approximately the same size as the conidia.

DAVIS (S. H.). **Sclerotium bataticola, a cause of damping-off in seedling conifers.**—*Science*, N.S., xcv, 2455, p. 70, 1942.

*Sclerotium bataticola* [*Macrophomina phaseoli*], isolated from Norway spruce (*Picea abies*) seedlings at the Allegheny Forest Experiment Station in 1935 by L. W. R. Jackson, was shown by the writer's inoculation experiments with pure cultures at the Morris Arboretum, University of Pennsylvania, to be pathogenic to germinating seeds and seedlings of its own host, Douglas fir (*Pseudotsuga taxifolia*), American larch (*Larix laricina*), and Jack, red, Scotch, and western yellow pines (*Pinus banksiana*, *P. resinosa*, *P. sylvestris*, and *P. ponderosa*, respectively). Pre- and post-emergence damping-off was observed in all the species tested and the fungus reisolated from the diseased plants at every stage of growth.

TUCKER (C. M.) & MILBRATH (J. A.). **Root rot of Chamaecyparis caused by a species of Phytophthora.**—*Mycologia*, xxxiv, 1, pp. 94–103, 14 figs., 1942.

The name *Phytophthora lateris* is proposed for the fungus causing a serious root rot of *Chamaecyparis* spp. in Oregon and Washington [*R.A.M.*, xx, p. 41]. The disease, which affects trees of all ages, first attacks the roots and thence spreads to the trunk and crown. The entire foliage undergoes complete discoloration (from blue to green and later tan in the blue cypress, and from green to tan in the green one) within a period of two to three months in cool and damp, or two to three weeks in hot and dry weather. Eventually, the leaves wither and dry up and the tree is killed. The condition could easily be mistaken for transplanting injury but for the very characteristic, clear line of demarcation between the necrotic and living tissues. Some blocks of nursery stock planted in infested soil were destroyed within six months, while in other infested plantings trees continued to die over a period of three to four years. When infection occurs in old-established hedgerows, three or four trees die each year, the spread being more rapid if there is drainage down the row.

The fungus is described as having hyphae continuous when young, becoming septate with age, usually smooth, but sometimes gnarled or tuberous. No sporangia develop on agar media, but they are fairly abundant on washed mycelial mats transferred from 7-day pea broth cultures (20° C.) to sterile distilled water and incubated 7 days at 20°; they are borne sympodially on sporangiophores resembling vegetative hyphae, mostly ovate, obovate, or obpiriform, occasionally elongate, hyaline to lemon-yellow, non-papillate, with a very thin and often indistinguishable apical refringent plug, 20 to 60 by 12 to 20 (average 36 by 15) $\mu$. The zoospores are fully differentiated within the sporangium, biciliate, reniform in the motile, spherical in the non-motile phase, 10 to 12 $\mu$ in diameter. Chlamydospores develop abundantly in agar and liquid media; they are usually subspherical to spherical, occasionally ovate to irregular, with contents densely and often coarsely granular, lemon-yellow to light brown, with a wall usually thin, sometimes thick (6 to 7 $\mu$), terminal or intercalary (the latter developing as lateral swellings of the hyphae, often appearing sessile at maturity), 20 to 77 (average about 40) $\mu$ in diameter, and germinate by germ-tubes. Oogonia, antheridia, or oospores were not observed. The optimum temperature for growth on maize meal agar was about 20°, growth being very restricted at 25°, and entirely inhibited at 30°. The fungus grows more slowly on potato dextrose, maize meal, and oatmeal agars than related species with non-papillate sporangia. Its pathogenicity was easily demonstrated by inoculating the bark or the soil around the roots with cultures or adding infested soil to the soil on the site of the future planting. All varieties of *C. lawsoniana* were found to be susceptible to the disease, some of *C. obtusa* were susceptible and others resistant, while all of *C. pisifera* showed resistance.

YORK (H. H.). **Tree-wound dressings.**—*Bull. Morris Arbor. Univ. Pa*, iii, 21, pp. 73–77, 1941.

Essential properties of a tree-wound dressing [*R.A.M.*, xxi, p. 53] should include non-injuriousness to the cambium and adjacent tissues; good penetrative capacity; a chemical content of strong fungicidal activity; a preventive influence in respect of drying-out and cracking of the wood; virtual insolubility in water; and resistance to extremes of temperature. Most of these requirements are fulfilled by orange shellac, an alcoholic and consequently germicidal preparation, which should be liberally applied to the inner living bark, cambium, and sapwood before treatment with a waterproof dressing, e.g., asphaltum dissolved in a volatile hydrocarbon, Bordeaux paint (Bordeaux mixture and raw linseed oil), or lead and zinc paints. Creosote and its mixtures or asphaltum dissolved in turpentine or mineral oil are apt to injure the cambial region of the wound, and are further not consistently reliable as antiseptics. Where the colour of the wound dressing is objectionable, shellac may first be applied to the cambial region, the exposed wood then sterilized with copper sulphate, the

dried surface again coated with shellac, and finally a paint put on to match the bark, finishing off with a spar varnish to prolong durability. Apart from the tediousness of this method, it has been found one of the most satisfactory of the wound dressings tested by the writer.

Rabanus (A.). **Der Schutz des Holzes gegen schädigende Einflüsse durch Pilze, Tiere und Chemikalien.** [The protection of timber against injurious influences of fungal, animal, and chemical origin.]—*Chem. Fabr.*, xiii, 21, pp. 388–394, 1940. [Abs. in *Holz Roh- u. Werkstoff*, iv, 8, p. 299, 1941.]

Following brief notes on the fungal, insect, and chemical agencies of damage to timber the various methods of protection are discussed, viz., painting, injection, vacuum pressure, sap expulsion, osmosis [*R.A.M.*, xx, p. 505], and bandaging as a supplementary treatment. The antiseptics mentioned include oils, especially coal tar oil, and the water-soluble substances, mercuric chloride, copper sulphate, zinc chloride, and fluorine compounds [ibid., xvii, p. 216; xix, p. 379], comprising fluralsil [ibid., xv, p. 546], basilite, zinc-meta-arsenite, and (of particular importance) the fluorine-chromium-dinitro and fluorine-chromium-arsenic-dinitro mixtures. During 1938 the consumption of coal tar oil and water-soluble impregnating salts in Germany amounted to some 120,000 and 2,000 tons, respectively, but the prevailing war conditions have limited the materials available for timber preservation to simple fluorine-dinitro mixtures and zinc chloride. The determination of the fungicidal efficacy of preservative substances is tested by the rapid DIN DVM 2176 process. Other subjects dealt with are the effects of alkaline and acid solutions on the treated wood, a brief reference to the relation between the breadth of the annual rings and wood quality, and the possibility of reducing the permeability of the timber by injections of appropriate substances.

Adams (G. A.) & Ledingham (G. A.). **Biological decomposition of chemical lignin. I. Sulphite waste liquor.**—*Canad. J. Res.*, Sect. C, xx, 1, pp. 1–12, 1942.

In an attempt to find profitable methods of utilizing sulphite liquors (a waste product of sulphite pulp manufacture produced in the ratio of approximately 10 tons of waste liquor for every ton of pulp, and containing on an average 10 to 20 per cent. solids, of which 60 per cent. is the lignin section and 15 to 20 per cent. the soluble sugars), the possibility of decomposing lignosulphonates by micro-organisms was investigated. The wood-staining fungus, *Endoconidiophora adiposa*, chosen for this study, proved capable of decomposing approximately 10 per cent. of the lignin fraction of sulphite liquor media as measured by the $\beta$-naphthylamine precipitation method. It was also capable of fermenting up to 86·61 per cent. sugar, whereas yeast is able to utilize only 60 per cent. of the total sugars. For the preparation of the cultural medium from the waste liquors, it was necessary to remove toxic substances such as the free sulphur dioxide (by boiling for 15 minutes with vigorous aeration), adjust the $P_H$ value at or slightly above 5·0 with the help of some neutralizing agent, and add nitrogen and phosphorus, in which the liquors are deficient. Of the neutralizing agents tested, the best results were obtained with a mixture of calcium and magnesium carbonates, or, in another test, with sodium carbonate. As sources of nitrogen, organic and ammonia nitrogen were more satisfactory than inorganic nitrates, while phosphorus may be used in form of various phosphates, of which ammonium phosphate has the advantage of supplying nitrogen at the same time.

Ledingham (G. A.) & Adams (G. A.). **Biological decomposition of chemical lignin. II. Studies on the decomposition of calcium lignosulphonate by wood destroying and soil fungi.**—*Canad. J. Res.*, Sect. C, xx, 1, pp. 13–27, 1942.

In the second contribution to this series [see preceding abstract], the lignin-decomposing properties of 106 cultures of wood-destroying and soil fungi were studied on a

standard synthetic medium containing calcium lignosulphonate isolated from sulphite waste liquor. In general, it appeared that wood-destroying fungi were more variable and difficult to cultivate than soil fungi. The *Alternaria* spp. gave consistently the greatest lignin breakdown, ranging from 12 to 18 per cent. in replicate tests, while *Fusarium* spp., although capable of equally good lignin decomposition in individual tests, gave varying results in duplicate experiments at a later date. Of the other genera tested, *Trichoderma* and *Phoma* are considered promising. A slight positive correlation was found between the Bavendamm tannic acid reaction for identifying lignin decomposing fungi and the lignosulphonate breakdown after 60 days' growth.

Afanasiev (M. M.). **Phosphate deficiency of Sugar Beets in Montana.**—*Plant Dis. Reptr*, xxv, 16, pp. 414–415, 1941. [Mimeographed.]

Phosphate deficiency, which is stated to be prevalent in sugar beet crops in the irrigated soils of Montana, is characterized by a necrotic, marginal or interveinal, brown to black foliar spotting, accompanied in severe cases by burning and shrivelling, the leaves presenting the aspect of an upward-curling crescent. The petioles may also be involved, turning black and dying, and thereby affording ingress to rot-producing organisms which may extend downwards into the roots. An important factor in the development of symptoms is believed to be an unbalanced nitrogen-phosphorus ratio. On land cropped to lucerne for several years sugar beets often develop black root [*R.A.M.*, xix, p. 637], succeeded in the surviving plants by acute phosphate deficiency, the nitrogen content of the soil being maintained during the growth of the lucerne while the available phosphates are materially reduced.

Hewitt (W. B.) & Houston (B. R.). **Association of Pierce's disease of Grapevines and Alfalfa dwarf in California.**—*Plant Dis. Reptr*, xxv, 19, pp. 475–476, 1941. [Mimeographed.]

Pierce's disease of the vine [*R.A.M.*, xix, p. 693] is stated to be increasing rapidly in many Californian vineyards, and to have completely destroyed many of them in some localities. Evidence has been obtained which demonstrates that the condition is due to a virus transmissible by grafting, while its manner of spread indicates the presence of an insect vector. In some areas, rapid spread appears to be associated with proximity to lucerne fields affected with dwarf disease [ibid., xvi, pp. 753, 816], which also appears to be spread by an insect. Lucerne dwarf has been present for some years in parts of southern California where Pierce's disease has been very severe, and is now very common in the San Joaquin Valley areas, where Pierce's disease has recently become important. Both in vineyards and lucerne fields, the first plants to become affected are generally found along the edges adjoining irrigation canals, ditches, roadsides, and fences, where various grasses have been allowed to grow.

Du Plessis (S. J.). **Isariopsis leaf-spot in Vines.**—*Fmg S. Afr.*, xvii, 190, pp. 60–65, 6 figs., 1942.

Vine leaf spot due to *Isariopsis fuckelii* (Thuem.) du P[lessis] [comb. nov. ?] [cf. *I. clavispora*: *R.A.M.*, xvii, p. 843] first appeared in South Africa in 1939–40, in a Stein grape vineyard in the Bottelary area, Stellenbosch. Infection was also noticed at Wellington. Only the leaves are affected, but the premature leaf-shedding caused may weaken the vines. The disease appears to develop about the middle of November, and then gradually spreads, particularly after rain, until vegetative growth ceases. The spots then rapidly become more numerous, especially after harvesting. All the leaves may become heavily infected one month after picking.

New spots are indistinct, blackish-brown, and more or less circular. Later, their circular shape becomes more regular. On the upper surface of the leaf they are sharply outlined by a slightly raised, narrow, dark brown margin, while the enclosed area is light greyish-brown. On the lower surface, fully developed spots are dark brown, and

the brown edge is less distinct, while the central parts are darkly speckled. When numerous spots are present, they may coalesce, causing a gradual yellowing and subsequent browning of the leaves. Discoloration starts at the top, and leads to desiccation, the leaves then being readily torn by the wind.

The fungus forms its spores in the middle of the spots, generally on the lower surface of the leaves. These spores are borne on broom-shaped conidiophores which are highly resistant and persist on old rotting leaves left lying in infected orchards. Infection spreads from such leaves during the spring. Entry occurs mainly through the stomata, infection being favoured by hot, moist weather. Heavy dew after harvesting assists rapid spread, but at this stage rain does not appear to be essential.

The most effective control consists in the removal and distribution of all leaves in affected vineyards, or their ploughing under during early winter, and in the thorough application of Bordeaux mixture (4–4–50), verderame dust, copper-sulphur dust, or (particularly) sulphur when the shoots are about 10 in. long, after flowering, four weeks later, and immediately after picking.

**Legislative and administrative measures.**—*Int. Bull. Pl. Prot.*, xv, 12, pp. 226M–227M, 1941.

Colombia. Decree No. 1123 of 20th June, 1941, places under the supervision of the Ministry of National Economy the functions of the Agricultural Department of Magdalena, established by Decree No. 671 of 3rd April, 1941, including those relating to the control of Sigatoka disease of bananas (*Cercospora musae*) [*R.A.M.*, xviii, p. 144]. Under the new arrangement, the campaign against Sigatoka disease will be carried out by the National Government in plantations where the treatment would be justified in the opinion of the Government technicians. Of the cost of fungicidal treatment and other necessary measures against the disease, 55 per cent. will be borne by the Government and the remainder by the growers concerned, to whom loans for this purpose will if necessary be made under the terms of the contract drawn up between the Government and the Magdalena Fruit Company.

Rumania. A Resolution (No. 1,129 of the Council of Ministers) of 15th September 1941, requires all farmers to treat with copper sulphate or other officially recognized chemicals any wheat seed-grain intended for the crop of 1941–2 as a precaution against bunt (*Tilletia* [*caries* and *T. foetida*: ibid., xviii, p. 732]), which is hereby declared an infectious disease injurious to its host.

Faes (H.). **Station fédérale d'essais viticoles et arboricoles à Lausanne et Domaine de Pully. Rapports annuels 1939 et 1940.** [Annual reports for 1939 and 1940 of the Federal Viticultural and Arboricultural Experiment Station at Lausanne and Domaine de Pully.]—*Annu. agric. Suisse*, lv, 7, pp. 703–738, 6 figs., 1941.

The following are among the items of phytopathological interest in these reports [cf. *R.A.M.*, xix, p. 262]. The cold spring of 1939, followed by a wet summer and autumn, greatly complicated the work of downy mildew [*Plasmopara viticola*] control. Both in 1939 and 1940, copper oxychloride of the cuprenox [ibid., xx, p. 339] type proved equally effective with Bordeaux mixture of comparable copper content (2 kg. copper sulphate = 1·6 kg. cuprenox) in the elimination of the fungus, the former possessing the further advantages of easy dilution without neutralization and absence of any tendency to scorch the foliage even of nursery plants. In wet seasons the normally advisable addition of a 'wetter' to Bordeaux mixture should be omitted. Reference has already been made [loc. cit.] to the promising results of experiments carried out in 1940 with a view to economizing in the use of copper for mildew control by the reduction of the copper sulphate content to 1 per cent., neutralized by the same amount of lime. Alkaline mixtures of this type dry up the rain drops on the leaves too rapidly for the pathogen to develop while the atmosphere is still moist. In 1940 the Station was presented with a stationary spraying installation, which has given entire

satisfaction. The popularity of such installations among Swiss vintners is constantly increasing.

Cryptonol [ortho-oxyquinoline: ibid., xviii, p. 554], applied to vines naturally or artificially infected by the coître or hail disease within three hours of the establishment of the pathogen (*Coniothyrium diplodiella*) [ibid., xvii, p. 375; xix, p. 263] on the host, retarded the spread of the fungus and virtually inhibited the formation of pycnidia; unwounded grapes were seldom involved and the axis never, with the result that comparatively little damage was caused.

Experiments on the joint control of apple scab (*Venturia* [*inaequalis*]) and codling moth (*Carpocapsa* [*Cydia*] *pomonella*) were conducted over the six-year period from 1933 to 1938, and confirmed the importance, in respect of the fungal parasite, of pre- and post-blossom treatments with 2 per cent. lime-sulphur plus 0·05 per cent. copper oxychloride [ibid., xx, p. 411].

The sole effective control measure in the case of apple mildew (*Podosphaera leucotricha*) [ibid. xix, p. 263] consists in the prompt and thorough excision of the infected leaf and flower clusters and the immediate application of lime-sulphur. Among the varieties particularly susceptible to this disease are Gravenstein, Jonathan, Transparent, Bismarck, Landsberg Reinette, and Cox's Orange Pippin, while the Canadian and Baumann's Reinettes and Beauty of Boskoop are fairly resistant.

For some years the standard method of combating shot hole [of stone fruits: *Clasterosporium carpophilum*], viz., one pre- and one post-blossom application of a 0·5 per cent. copper-containing mixture or 2 per cent. lime-sulphur has been superseded by a single combined insecticidal and fungicidal treatment, immediately before the resumption of growth, of 4 per cent. soluble carbolineum plus 2 per cent. copper oxychloride [loc. cit.], the results obtained with which in 1939 and 1940 were fully equal to those of the ordinary schedule.

The following programme is recommended for the control of *Didymella applanata*, which was first observed in Switzerland in 1915 and now causes heavy depredations in raspberry plantings [ibid., xvii, p. 375]: removal and burning of dry or wilting shoots in the spring; two to three applications, between mid-May and flowering, of Bordeaux mixture or copper oxychloride plus an adhesive; post-harvest (August to September) treatments with copper dusts; and during the dormant period (November to February) spraying with 2 per cent. Bordeaux mixture.

The season of 1939 was very conducive to the infection of gooseberries by anthracnose (*Pseudopeziza ribis*), which defoliated untreated bushes by the end of August, except in the case of the resistant Red Dutch, Eastling aus Vierlanden, White Versaillaise, and Haughton Castle varieties. Good control (except on the highly susceptible Large White, Hero, and Fay's New Prolific) was obtained by the application on 31st March of 1 per cent. Bordeaux mixture or 0·5 per cent. cuprenox and on 7th and 19th May of 0·5 per cent. Bordeaux mixture or 0·2 per cent. cuprenox.

Endives are grown on a large scale in the canton of Geneva and round Yverdon, where they are subject to attack by *Sclerotinia minor* and *S. sclerotiorum*. Satisfactory control of the pathogens on a small scale was effected by soil disinfection with formalin, mercurial products, or steam (particularly the last-named), but these methods would be impracticable in commercial plantings, where attention should be directed to the application of a well-balanced manuring system with a basis of potash and phosphoric acid, excluding nitrogen and organic matter, and avoiding a sequence with lettuce, carrots, or other hosts of the fungi concerned.

**Plant diseases. Notes contributed by the Biological Branch.**—*Agric. Gaz. N.S.W.*, liii, 1, pp. 29–32, 3 figs., 1942.

In New South Wales, humid weather during January and February is often accompanied by epidemics of peach and nectarine brown rot (*Sclerotinia fructicola*) [*R.A.M.*, xix, p. 550; xxi, p. 123]. Provided careful attention has been given to orchard sanita-

tion, good results are to be looked for from fruit cover sprays applied a few days before picking. In the coastal, tableland, and hill districts, where dessert varieties are cultivated, copper sprays cannot be applied to peach or nectarine trees in leaf without severe foliage injury, but the following sulphur treatments have proved satisfactory: lime-sulphur (commercial liquid lime-sulphur containing approximately 20 per cent. polysulphide sulphur W/V), 1 gal. to 160 gals. water; colloidal sulphur, 1 to 2 lb. per 100 gals. water; wettable sulphurs 5 lb. per 100 gals. water; and a combination of 1 gal. lime-sulphur in 320 gals. water, plus either colloidal sulphur 1 lb. to 100 gals. or wettable sulphur 5 lb. per 100 gals. This last mixture combined good coverage and low potentiality for polysulphide injury, with a reasonably high sulphur content. An effective wetting and spreading agent should be combined with each of these sprays.

Diseases recorded for the first time in New South Wales during November, 1941 included papaw powdery mildew, due to a species of *Oidium*, an apricot bacteriosis, due to an organism as yet unidentified, the symptoms of which consisted in blossom blight, tip-wilt, leaf spot, and twig and limb cankers with gumming, and peach rusty spot [ibid., xx, p. 311], observed from time to time since 1933–4, but not before recorded.

WILLIAMS (R. O.). **Trinidad and Tobago. Administration Report of the Director of Agriculture for the year 1940.**—16 pp., 1942.

This report [cf. *R.A.M.*, xix, p. 261] contains (pp. 4, 14) the following items of phytopathological interest. The cacao industry in Trinidad has seriously deteriorated owing to witches' broom [*Marasmius perniciosus*: ibid., xx, p. 453] and inadequate cultivation. The continued spread and increased intensity of infection by *M. perniciosus* make the discovery of resistant strains a problem of the utmost importance. Resistance trials are in progress at Marper with material from the Amazon, Ecuador, and Trinidad. The most disturbing feature of the disease is the increase in pod infection during recent years. In Tobago infection is very slight and limited to certain small areas.

Grapefruit scab [*Elsinoe fawcetti*: ibid., xvii, p. 454; xx, p. 460] continues to threaten the production of clean fruit for export in the same limited area as before, but infection was not severe. The loss of numerous lime trees and the deterioration of others through root disease [cf. ibid., xv, p. 716; xvii, p. 671] is a serious problem in lime cultivation throughout the island.

The loss of Bocare immortelle trees [*Erythrina glauca*] through *Sphaerostilbe musarum* [*Calostilbe striispora*: ibid., xx, p. 453] is of importance because of the resultant exposure of the cacao and the ingress of grass weeds. The fungus was common on moribund cacao during the rains.

Banana output remains limited owing to the prevalence of leaf spot [*Cercospora musae*], the severity of which is much reduced by shade; and the provision of light shade for bananas is recommended.

WALLACE (G. B.). **Report of Plant Pathologist.**—*Rep. Coffee Res. Exp. Sta., Lyamungu, Moshi, 1939* (*Pamphl. Dep. Agric. Tanganyika* 27), pp. 17–18, 1941.

During 1939, further spraying tests against coffee leaf disease (*Hemileia*) [*vastatrix*] were conducted in Tanganyika [*R.A.M.*, xix, p. 591; xx, p. 573], using 1 per cent. Bordeaux mixture, 0·5 per cent. Bordeaux mixture, and a proprietary form of copper hydroxide. The results indicated that the first two treatments were equally satisfactory, while the third hardly gave any improvement over the control. The end of February would appear to be the best time for spraying, especially if the trees have not been sprayed before. If a second application is required, the end of November is the most suitable time. Growers wishing to apply the full quantity of Bordeaux mixture should apply half strength at the end of February and the end of November.

Plum trees in the Usambara mountains showed root infection by *Ustulina zonata*, on

the fructifications of which an unidentified species of *Nectria* was observed. Apple trees in the same locality were affected by pink disease (*Corticium salmonicolor*). Gram [*Cicer arietinum*] leaves at Lindi showed infection by *Uromyces appendiculatus* and lucerne on Kilimanjaro by *U. striatus*. Cowpeas at Lindi were attacked by mildew (*Erysiphe polygoni*), though mosaic is locally the most severe disease of this crop.

WALDEE (E. L.), KENT (G. C.), & MELHUS (I. E.). **Studies in the redistribution of some phytopathogenic species of Bacillus.**—Abs. in *Proc. Iowa Acad. Sci.*, xlvi (*1939*), pp. 179–180, 1940.

The recent exclusion from the genus *Bacillus* of non-endospore-formers [*R.A.M.*, xvi, p. 482] necessitates a revision of the position of eight species of peritrichous phytopathogenic organisms. Preliminary cultural and cross-inoculation studies on 75 isolates of the latter indicated their relegation to two separate and distinct groups, one of which may be included in *Erwinia*, while the other, comprising the agents of soft rot, will either be referred to an already existing genus or form the foundation of a new one.

WALDEE (E. L.). **The relationship of some bacterial plant pathogens to the coliform bacteria.**—Abs. in *Proc. Iowa Acad. Sci.*, xlviii (*1941*), p. 197, 1941.

Of twelve species of bacterial plant pathogens compared by means of cultural and biochemical tests with certain coliform bacteria, only one, *Bacterium dissolvens* [*R.A.M.*, xii, p. 426], was found to belong to the latter group, and should be regarded as a member of the genus *Aerobacter*. The soft rot organisms [see preceding abstract], *Bacillus carotovorus* [*Erwinia carotovora*], *B. phytophthorus* [*E. phytophthora*], *B. atrosepticus* [*E. phytophthora*], *B.* [*E.*] *aroideae*, and *B. melonis*, differed in various important respects from the coliform bacteria, but appear to be very closely related to *Serratia marcescens*. *B. amylovorus* [*E. amylovora*], *B. tracheiphilus* [*E. tracheiphila*], and *B.* [*E.*] *salicis* have already been relegated to *Erwinia* and shown to be only distantly connected with the coliform group. The exact affinities of *Bact.* [*Xanthomonas*] *stewarti* are still in doubt, but it appears to be closely allied to *Erwinia*, while *B.* [*E.*] *lathyri* and *B.* [*E.*] *ananas* approximate to *S. marcescens* rather than to the coliform bacteria.

LACEY (MARGARET S.). **Studies in bacteriosis. XXV. Studies on a bacterium associated with leafy-galls, fasciations and 'cauliflower' disease of various plants. Part IV. The inoculation of Strawberry plants with Bacterium fascians (Tilford).**—*Ann. appl. Biol.*, xxix, 1, pp. 11–15, 1 pl., 1942.

In further studies on the organism causing fasciation in sweet peas and various growth abnormalities in other plants, identified in a previous paper as *Bacterium fascians* [*R.A.M.*, xviii, p. 596], inconclusive results were obtained from inoculations of strawberry plants grown from runners in an attempt to reproduce the 'cauliflower' disease. Of all plants inoculated during a period of 18 months at all stages of growth, only 25 per cent. developed 'cauliflower' symptoms of varying degree at various times after inoculation, but most of them recovered completely after some time, only a few plants dying as a result of severe infection. The inoculation of strawberry seedlings (variety St. Jean), carried out during 1938, produced infection in 20 out of a total of 36 plants, while seven died after inoculation, probably from wounds. Of the infected plants, nine were severely diseased, three dying 5 to 10, and six 14 months after inoculation; the remaining 11 plants were only slightly affected, four of them recovering during the following summer, while seven remained small and unhealthy looking, but showed no definite 'cauliflower' symptoms. Of the 36 St. Jean seedlings inoculated during 1939, 30 developed some type of abnormal growth one to ten weeks after inoculation; of these one half developed definite gall tissue and the other half abnormalities such as the division of the primary shoot into several poor, weak secondary

crowns and the production of small, fasciated leaves. An attempt to infect St. Jean seedlings in the absence of wounds (by brushing) was successful, seven plants out of 24 developing gall tissue within a period of 5 to 12 weeks after inoculation.

SINGH (B. N.). **Selection of bacterial food by soil flagellates and amoebae.**—*Ann. appl. Biol.*, xxix, 1, pp. 18–22, 1942.

The selectivity in bacterial food by one large and one small amoeba and a soil flagellate, *Cercomonas crassicauda*, was tested on cultures of 48 strains of bacteria, which included a miscellaneous group mostly from soil, a group of *Rhizobium* strains, and a group of plant pathogens, composed of *Phytomonas* [*Bacterium*] *tumefaciens*, *P.* [*Xanthomonas*] *hyacinthi*, *P.* [*Pseudomonas*] *mori*, *Phytomonas* [*X.*] *phaseoli*, *P.* [*Pseudomonas*] *syringae*, *Phytomonas* [*X.*] *malvacearum*, *Erwinia tracheiphila*, *E. carotovora*, and *E. solanisapra*. Of the latter group, all were either completely or partly eaten by *C. crassicauda*; and all but the two strains of *X. hyacinthi* and the one of *X. phaseoli* used were completely eaten by the two amoebae (with the exception of one of the three strains of *Bact. tumefaciens* used, which was eaten by the large, but not by the small amoeba). The plant pathogens that were inedible by amoebae produced an exo-toxin harmful to amoebae, but apparently without effect on the flagellate. Since it thus appears that some plant-pathogenic bacteria are eaten by protozoa, it is concluded that the incidence of bacterial diseases of plants may be influenced by the presence of protozoa in the soil.

WIESNER (B. P.). **Bactericidal effects of Aspergillus clavatus.**—*Nature, Lond.*, cxlix, 3778, pp. 356–357, 1942.

Two strains of *Aspergillus clavatus* were found capable of sterilizing liquid media infected with *Staphylococcus aureus* and other organisms. These moulds invested simple liquid media such as Czapek Dox solution with distinct antibactericidal properties. Small portions of the medium on which the mould has been grown inhibit the growth of *S. aureus* in glucose broth and other media. Larger quantities of medium are bactericidal. In intermediate dilutions an initial phase of bacteriostasis may be followed by bactericidal action. The active substance differs from penicillin [*R.A.M.*, xxi, p. 67] in being bactericidal as well as bacteriostatic, in being relatively stable, and in inhibiting and killing a number of organisms not attacked by penicillin.

NOVITZKI (S. I.) & KOKOINA (MME R. I.). Ржавчина злаков и меры борьбы с нею. [Rusts of Gramineae and their control.]—99 pp., 11 figs., Rostoff-on-Don, Rostoff District Publishing Office, 1941. Roubles 1·75.

This is a popular booklet on the rusts of cereal crops and their control under conditions obtaining in southern U.S.S.R.

CRAIGIE (J. H.). **Aerial dissemination of plant pathogens.**—*Proc. sixth Pacif. Sci. Congr., 1939*, pp. 753–767, [? 1940].

In this paper the author discusses, with numerous references to the relevant literature, the question of the aerial dissemination of plant pathogens. The points dealt with include high spore production by certain fungi, altitudes reached by spores, rate of fall, distance carried, and relation of aerial spread to distribution of physiologic races of cereal rusts (*Puccinia* spp.).

WATERHOUSE (W. L.) & WATSON (I. A.). **Australian rust studies. VI. Comparative studies of biotypes of race 34 of Puccinia graminis tritici.**—*Proc. Linn. Soc. N.S.W.*, lxvi, 5–6, pp. 269–275, 1 pl., 1941.

A tabulated account is given of the comparative cultural experiments carried out at St. Paul, Minnesota, in 1939, and at the University of Sydney in 1940 to determine the relationship between the American and Australian physiologic races of *Puccinia graminis tritici* both designated 34 [*R.A.M.*, ix, p. 703; xx, p. 522]. Judging by the

inconsistent reactions to the two races of a number of standard differential and other wheat varieties and inbred lines of rye when tested at varying temperatures and light intensities, as well as by differences in the colour of the uredosori, which are burnt sienna in the United States race and Sanford's brown (Ridgway) in the Australian, two distinct entities are represented. In the authors' opinion, these are best described by the term 'biotypes' (defined as a single individual or group of individuals having the same genetic constitutions), as proposed by Christensen and Rodenhiser [ibid., xix, p. 731], since neither 'physiologic race' nor 'isolate' bears quite the requisite connotation. In the case of *P. g. tritici* two isolates may or may not be the same biotype. Where hybridization on barberries is prevalent, a physiologic race may be expected to comprise a number of biotypes, but under Australian conditions, where infection of the alternate host is rare, race 34 probably embraces relatively few biotypes, which have mostly arisen in the asexual stage.

Corkle (Marie A.) & Melhus (I. E.). **The earliest known epiphytotic of rust in Iowa.**—*Proc. Iowa Acad. Sci.*, xlviii (*1941*), pp. 147–157, 1941.

The writers have collected a number of county agricultural societies' and newspaper reports, as well as statistical data, bearing on the disastrous failure of the Iowa wheat and oats crops in 1858 due to rust (presumably stem rust [*Puccinia graminis*]).

Holton (C. S.) & Rodenhiser (H. A.). **New physiologic races of Tilletia tritici and T. levis.**—*Phytopathology*, xxxii, 2, pp. 117–129, 1 fig., 1942.

Three new physiologic races of *Tilletia tritici* [*T. caries*], T–12, T–13, and T–14, and two of *T. levis* [*T. foetida*], L–9 and L–10, are described, bringing the total number of known races of the two smuts to 24, 14 of the former and 10 of the latter species [*R.A.M.*, xxi, p. 249]. The three new races of *T. caries* originated, respectively, in Oregon, Washington, and Idaho, and the two of *T. foetida* in Idaho and Washington, T–12 and T–14 having been collected in commercial wheat fields, T–13 on Albit in a nursery, L–9 on Ridit, in a commercial field, and L–10 also on Ridit in an increase plot.

In a series of tests on differential wheat varieties from 1937 to 1940, T–12 was distinguished by the susceptible reaction of Hohenheimer, Albit, and White Odessa, and the intermediate response of Martin, T–13 by its pathogenicity to Ridit, Hassar, Albit, and White Odessa and T–14 by the susceptibility of Albit and White Odessa only. The identity of L–9 is based on its pathogenicity to Ridit and Albit, and that of L–10 on the intermediate reaction of Ridit. The average number of internodes per culm in Hybrid 128 and Albit inoculated with T–13 was 5·8 compared with the same figure and 5·7 in the bunt-free controls of the two varieties, and the length of the internodes 12·8 and 13·7 cm., respectively, as against 17·2 and 16·9 cm., respectively, in the controls. Apart from the development of T–13 from T–11, presumably through a genetic change not yet fully understood, most of the races used in tests on winter wheats at Pullman, Washington, have proved highly stable.

Leeper (G. W.). **Manganese deficiency and accumulation of nitrates in plants.**—*J. Aust. Inst. agric. Sci.*, vii, 4, pp. 161–162, 1941.

In work at Melbourne University, oats were grown in a small experimental area in which this plant develops 'grey speck' [*R.A.M.*, xxi, p. 193]. The soil is a grey sandy loam overlying yellow clay, and was heavily limed twenty years ago. Seeds are sown with a mixture equivalent to 300 lb. per acre of superphosphate and 20 lb. of manganese sulphate, but oats are still affected, though barley and wheat are not. Every oat plant showing marked symptoms of manganese deficiency was ascertained to give a strongly positive reaction for the presence of nitrate in the stalk. At the same time, Dawn oats growing in two pots of Western Australian gravelly soil successfully treated to overcome grey speck did not show a trace of nitrate, while Black Mesdag

oats on the University soil gave only a slight nitrate reaction. This strain is relatively insensitive to manganese deficiency. Canary grass (*Phalaris minor*) a common weed in this soil, displaying the same leaf markings as oats when affected by manganese deficiency, though it is less susceptible, showed no trace of nitrate when healthy, though affected plants gave an intense reaction. Wimmera rye grass [*Lolium perenne*], growing vigorously in the same soil, showed no trace of nitrate. The amount of nitrate present in the soil at the time was under one part per million of nitrogen.

WARK (D. C.). **Addition of hormones to mercurial fungicidal dusts that reduce germination of Wheat.**—*J. Aust. Inst. agric. Sci.*, vii, 4, pp. 156–158, 1941.

Evidence having been obtained that a fungicidal dust containing 1·5 per cent. of mercury as ethyl mercury phosphate appreciably reduced the germinability of wheat seed-grain stored for two to eight weeks before seeding, a trial was made in which $\alpha$ naphthyl acetic acid and $\beta$ indolyl acetic acid were each carefully ground into samples of a dust containing 1·5 per cent. of mercury as ethyl mercury phosphate, giving a range of concentrations of from 2·5 to 40 parts per million of the dry weight of the seed when the dust was used at the rate of 2 oz. per bush. After 13 weeks' storage, a field germination test was made. The undusted seed then gave 77·3 per cent. germination, as against 47 per cent. for that dusted without hormones. The samples containing 2·5, 5, 10, 20, and 40 p.p.m. $\alpha$ naphthyl acetic acid gave, respectively, 56·3, 51·3, 57·8, 58·3, and 59·3 per cent. germination, the corresponding figures for the samples with $\beta$ indolyl acetic acid being 64·8, 59·3, 58, 55·8, and 48 per cent.

In laboratory germination studies it was noted that the mercurial dust reduced the average length of the root system and coleoptile, and that $\beta$ indolyl acetic acid, except at the lowest concentrations, still further reduced them, the reduction increasing with increasing concentrations.

A further trial was then made, in which $\beta$ indolyl acetic acid was used at concentrations of 0·5 to 4 parts per million with two mercurial dusts each containing 1·5 per cent. of mercury as ethyl mercury phosphate, applied at the rate of 2 oz. per bush. The treated seed was stored for six weeks before sowing. The mean figures for the results with both dusts were, no treatment 75·2 per cent. germination, dusts alone 59·1 per cent., and dusts plus 0·5, 1, 2, and 4 p.p.m. $\beta$ indolyl acetic acid, 59·6, 59·5, 62·4, and 65·1 per cent. germination, respectively.

These results demonstrate that $\beta$ indolyl acetic acid, when incorporated in a dust containing ethyl mercury phosphate, slightly reduces the adverse effect on the germination of wheat seed. The lower germination where $\beta$ indolyl acetic acid was used at concentrations over the optimum does not support the view that the effects of the hormones are due to the reaction between the mercurial dusts and the added substances reducing the amount of active material in the dust, or to the mechanical grinding causing a loss of volatile components.

WILSON (W. E.). **Physiological studies on two species of Diplodia parasitic on Corn.**—*Phytopathology*, xxxii, 2, pp. 130–140, 1942.

In the writer's cultural studies at the University of Illinois on species of *Diplodia* parasitic on maize, viz., *D. zeae* and *D. macrospora*, with particular reference to their carbohydrate metabolism [*R.A.M.*, xvii, p. 238], the basic medium consisted of 0·25 gm. magnesium sulphate, 0·3 gm. potassium dihydrogen phosphate, 2 gm. potassium nitrate, 30 gm. of a carbohydrate, and distilled water to make up to 1 l.

A substance that enabled *D. macrospora* to develop in the presence of simple sugars was extracted from maize, oats, sugar beets, molasses, hyphae of the same pathogen from actively growing cultures, and a dextrose medium staled by *D. zeae*. Growth was further promoted by an invertase solution and a commercial biotin concentrate. The growth factor elaborated by *D. zeae* and present in a concentrate of dextrose media staled by the fungus is believed to be either biotin itself or a closely related

compound. Tests carried out on samples from various stages of the process whereby starch is converted to dextrose indicated that the growth factor contained in starch is not present to any significant extent in dextrose, but remains in the mother liquor removed from the latter after crystallization. The source of the maltose and sucrose added to the media exerted a marked influence on the growth of *D. macrospora*, the average mycelial contents per flask of 125 ml. on Pfanstiehl C.P. maltose and a brown technical maltose, for instance, being 30 and 427·1 mg., respectively, while similar variations were observed in connexion with sucrose, the average yield for substrata enriched with Baker's analysed C.P. sucrose, Coleman and Bell C.P. saccharose, C & H Pure Cane sugar from 2 lb. box, Domino Cube, and C. & W. Beet Sugar from 10 lb. bag being 41·1, 90·0, 48·1, and 27·8 mg., and very sparse, respectively. *D. zeae* on the other hand, grew equally well whatever the source of sucrose.

It is apparent from these results that many complex carbohydrates can only be utilized by *D. macrospora* if they contain in the form of an impurity an essential growth factor for the fungus, which is apparently removed from simple sugars during the manufacturing processes.

Edwards (E. T.). **The relation of mineral nutrition to seedling blight infection in Maize.**—*J. Aust. Inst. agric. Sci.*, vii, 4, pp. 147–154, 1 fig., 1941.

Experiments were carried out at the University of Wisconsin to determine the effect of nitrogen, phosphorus, and potassium nutrition on the growth of maize seedlings and on their infection by *Gibberella fujikuroi* and its var. *subglutinans* [*R.A.M.*, xix, p. 589; xxi, p. 72]. The effect of each element was studied separately, by varying its concentration in an otherwise constant nutrient solution, 7,200 potted seedlings being used. During the first two to three weeks' growth, the omission of any one of the three elements did not seriously affect growth. In sterile sand cultures to which only distilled water was supplied, satisfactory growth went on for 10 to 12 days at 24° and 28° C. It appears that maize grain contains sufficient reserves of essential nutrients to render the seedlings largely independent of external nourishment during the early stages of growth, which is precisely the critical period for infection by the fungi in question. It is therefore unlikely that soil fertility is a significant factor in the development of seedling blight diseases of maize.

Bain (D. C.). **Preliminary studies of a Sorghum leaf-spot in Louisiana.**—Abs. in *Proc. La Acad. Sci.*, vi, p. 48, 1942.

Sweet sorghum [*Sorghum saccharatum*] at Baton Rouge, Louisiana, was observed in the autumn of 1940 to be affected by a conspicuous foliar spotting caused by a fungus provisionally identified as *Titaeospora andropogonis* [*R.A.M.*, xii, p. 248], which was subsequently isolated also from Johnson grass [*S. halepense*] and from surface-sterilized seeds and glumes of diseased sorghum plants. This is apparently the first record of the fungus under observation in the United States, though its presence in China has been previously reported [loc. cit.]. An organism isolated by C. L. Le Febvre from Sudan grass [*S. sudanense*] at Arlington Farm, Virginia, in 1939 is also believed to be identical with *T. andropogonis*.

The pathogen sporulates profusely on the host and in culture, sclerotia likewise being produced under both conditions. In stained leaf sections, acervuli were observed to develop exclusively from the stomata. The optimum temperature for growth was found to be about 28° C. Infection was experimentally induced in one- and four-month-old sorghum seedlings in 16 and 24 hours, respectively.

Quinn (N. R.). **A chlorotic condition of Citrus trees.**—*Fruit World, Melbourne*, xliii, 1, pp. 13–14, 1942.

For some years past, citrus trees in many of the older groves of the Torrens Valley, South Australia, have shown a chlorotic condition somewhat resembling mottle leaf,

but differing from it in that the pattern is less clearly defined and the leaves do not show any conspicuous narrowing. In mature leaves the midrib and main veins are typically green, with a green margin of varying width on either side. The interveinal areas are lighter green, or may be yellowish. There is no noticeable reduction in leaf size. A preliminary spraying test in 1940–1 with commercial manganese sulphate having brought about a striking improvement in one case, another affected tree was sprayed in February, 1941, with a solution containing 2 per cent. of chemically pure manganese sulphate and calcium caseinate. Two months afterwards the sprayed foliage had become normal. More extensive tests are planned.

PFÄLTZER (A.) & DE FLUITER (H. J.). **De wortelluisschimmel, Polyporus coffeae Wakef.** [The root louse fungus, *Polyporus coffeae* Wakef.]—*Arch. Koffiecult. Ned.-Ind.*, xv, 1, pp. 121–142, 7 figs., 1941. [English summary.]

This is a comprehensive study of the identity, geographical distribution, morphology, culture, life-history, and economic importance of *Polyporus coffeae* [*R.A.M.*, xiv, p. 31], the first reference to the occurrence of which in Java dates from 1911 (correspondence of the Malang Experiment Station), when it was, however, confused with the brown root fungus, *Fomes noxius*. The fruit bodies were not detected until 1936, at the same Station; in 1938 they were again observed on an estate in the Besoeki district. The coffee roots, which were parasitized by mealy bugs (*Pseudococcus deceptor* Gr.), were covered by a mycelial crust, mixed with soil particles and containing the organs described by Miss Wakefield (*Kew Bull.*, p. 308, 1917) as conidia, but probably more aptly termed chlamydospores. The sporophores are produced, not only round the collar of the tree, but also on the lateral roots. The genetic connexion between the mycelium and the sporophores was established by macroscopic examination, supplemented by pure culture on malt agar from basidiospores, which gave rise to the conidial stage of the fungus, *Bornetina corium*, thereby confirming Miss Wakefield's opinion and refuting that of Maublanc and Roger, who questioned the relationship [*R.A.M.*, xiv, p. 357]. *Polyporus coffeae*, which was found exclusively in symbiosis with *Pseudococcus deceptor*, did not appear, from observations extending over a period of 2½ to 5 years, to impair the health of the trees in any way, 85 per cent. falling into the 4 and 5 categories, i.e., assessed as 'good' and 'very good', respectively. In some cases eelworms (*Tylenchus pratensis* and *T. similis*) participate in the infestation of the trees, the state of which then does deteriorate, but there are no grounds for attributing even facultative parasitism to *Polyporus coffeae* itself.

TALLEY (P. J.) & BLANK (L. M.). **Some factors influencing the utilization of inorganic nitrogen by the root rot fungus.**—*Plant Physiol.*, xvii, 1, pp. 52–68, 1 graph, 1942.

This is a detailed, tabulated account of the writers' laboratory studies at the Texas Agricultural Experiment Station on the factors affecting the utilization of inorganic nitrogen by *Phymatotrichum omnivorum* in synthetic nutrient solutions. Much of the information has already been noticed from another source [*R.A.M.*, xx, p. 75], but attention may be directed to the following points. The consumption of nitrate nitrogen is influenced by the balance between potassium and magnesium, both of which are tolerated over a wide range providing the ratio of one to the other is neither unduly high nor extremely low. To a limited extent calcium may be substituted for magnesium and sodium for potassium. Ammonium utilization is modified by the ionic balance in the solution, the uptake by the organism of this source of energy being promoted, for instance, by high magnesium and high phosphates and by high calcium or sodium and high sulphates or chlorine, whereas a combination of high magnesium and high sulphates or chlorine acted adversely on growth. *P. omnivorum* proved to be tolerant of nitrites and able to assimilate nitrite nitrogen.

ROGERS (RUTH E.), WHEELER (HELEN G.), & HUMFELD (H.). **Physical and chemical changes produced in bleached Cotton duck by Chaetomium globosum and Spirochaeta cytophaga.**—*Tech. Bull. U.S. Dep. Agric.* 726, 35 pp., 2 pl., 2 figs., 1 diag., 12 graphs, 1940.

At the Bureau of Home Economics, United States Department of Agriculture, a bleached, de-sized, 14 oz. cotton duck was sterilized, inoculated with *Chaetomium globosum* [*R.A.M.*, xxi, p. 152 and next abstract] and a bacterium, *Spirochaeta cytophaga*, and then incubated on a mineral salts agar medium. Physical and chemical tests were made on samples of the fabric removed at intervals up to 15 and 18 days for the fungus and bacterium, respectively. Hyphal penetration into the fabric by *C. globosum* was shown by means of staining with basic fuchsin. During the period of perithecial and spore production by the fungus, i.e., between the third and seventh days, there was a decrease in carbon dioxide evolution, followed by a return to the initial rate and the attainment of a maximum about the tenth day, after which accumulation proceeded uniformly until the close of the test. Deterioration of the fabric by *C. globosum* was more rapid and complete than in the case of the bacterium, loss in weight, for instance, after nine days amounting to 15·4 and 6·8 per cent., respectively, while other properties impaired were breaking strength, thickness, and staple length, resulting in considerable breakage of the fibres.

KLEMME (DOROTHEA E.). **A study of oxygen absorption and catalase production during growth of Chaetomium globosum on Cotton fibre and yarn.**—*J. Bact.*, xliii, 2, pp. 171–180, 2 figs., 3 graphs, 1942.

At the Bureau of Home Economics, United States Department of Agriculture, Sea Island cotton fibre and yarn manufactured therefrom were sterilized, inoculated with *Chaetomium globosum* (which is stated to have been found on nearly all the samples of awnings, tarpaulins, shock covers, tents, and the like examined in the laboratory of the above-mentioned institution) [see preceding abstract], and incubated for 28 days in a Warburg apparatus. In both materials the daily oxygen consumption reached a maximum at about the eleventh day, after which the rate decreased (almost imperceptibly from the 18th to the 28th). Coinciding with the production of perithecia by the fungus, there was a slight fall in the rate of oxygen absorption on yarn between the fifth and eighth days, followed by a renewed increase until the attainment of the peak. The amount of oxygen absorbed by *C. globosum* on the fibre sample was significantly greater than that consumed by the yarn (0·32 milli-equivalents per gm. as compared with 0·21). Corresponding to these differences was a much more extensive output of catalase on the fibre than on the yarn, indicating the superiority of the former as a substratum for the fungus. It was further shown by preliminary experiments that the organisms growing on unsterilized, uninoculated samples of Acala cotton fibre consumed a materially larger quantity of oxygen than those present on unbleached cotton fabric, denoting that raw cotton is likely to deteriorate more rapidly than yarn or fabric in a moist atmosphere.

CHARLES (VERA K.). **A preliminary check list of the entomogenous fungi of North America.**—*Insect Pest Surv. Bull., U.S.*, xxi, 9 (*Suppl.*), pp. 707–785, 1941. [Mimeographed.]

The data presented in this provisional catalogue of the entomogenous fungi (excluding the Laboulbeniaceae) of the North American Continent (including Central America and the West Indies) are based primarily on an index of these organisms which has been maintained for many years as part of the mycological collections of the Bureau of Plant Industry. Annotated lists, arranged in alphabetical order, are given of (a) the fungi with their hosts and distribution, and (b) the insects with the fungi parasitic on each species. A four-page bibliography of selected references to the relevant literature is also included.

MASERA (E.). **Miceti patogeni al Bombyx mori L.** [Fungi pathogenic to *Bombyx mori* L.]—*Riv. Parassitol.*, iv, pp. 51–60, 1940. [Abs. in *Zbl. Bakt.*, Abt. 1 (Ref.), cxl, 11–12, pp. 238–239, 1941.]

Besides being subject to spontaneous infection by *Beauveria bassiana* and *B. globulifera*, silkworms (*Bombyx mori*) [*R.A.M.*, xviii, pp. 521, 735] at the Padua Silk-Growing Experiment Station were successfully inoculated with *Spicaria fumoso-rosea* [ibid., xviii, p. 532], *Metarrhizium anisopliae* [ibid., xviii, p. 380], *Sporotrichum paranense* [ibid., xvi, p. 530], and *B. densa* [ibid., xx, p. 301].

PARDO-CASTELLO (V.), LEON (E. R.), & TRESPALACIOS (F.). **Chromoblastomycosis in Cuba.**—*Arch. Derm. Syph., Chicago*, xlv, 1, pp. 19–31, 6 figs., 1942.

The writers report 31 cases of chromoblastomycosis in Cuba, where the disease falls into five distinct clinical types: all the patients except one were farmers, mostly between 40 and 60 years of age. Pure cultures were obtained from 11 cases on Sabouraud's agar and other standard media, on which the causal organism agrees with the published descriptions of *Fonsecaea* (*Acrotheca*, *Hormodendrum*, *Gomphinaria*) *pedrosoi* [*R.A.M.*, xxi, p. 14]. The colonies are dark green or brown to black, and the long, regularly septate, branched hyphae measure 2 to 6 $\mu$ in diameter, some producing apically or laterally a row of three or four dark, round, thick-walled cells, 10 to 14 $\mu$ in diameter, closely resembling the 'sclerotia' found in sections of tissue and in the scales and pus. Arthrospores of varying dimensions developed in all the cultures after four days. According to the substratum, the circular, oval, or elliptical conidia measure 1 to 6 $\mu$ in diameter (up to 8 $\mu$ on Czapek's medium), and may be grouped in clusters of a few to several hundred on concatenate conidiophores of variable shape and size with or without septa. Phialides occurred in one culture only.

HOOPER (K. H.) & WANNAN (J. S.). **Torulosis in Queensland.**—*Med. J. Aust.*, xxviii (ii), 24, pp. 669–671, 7 figs. (6 in *Suppl.*), 1941.

In 1941, at the Department of Health, Brisbane, *Debaryomyces hominis* [*D. neoformans*] was isolated on Sabouraud's maltose agar at 37° C. from the cerebrospinal fluid during the lifetime of the patient, a 57-year-old woman who succumbed to the disease about six weeks after its onset [cf. *R.A.M.*, xx, p. 578]. The fungus was shown to be pathogenic to mice, in the brains of which it produced the gelatinous cystic masses characteristic of Benham's group III of *Cryptococcus* [ibid., xv, p. 153]. This is apparently the first case of the disease to be reported from Queensland and the sixth record for Australia.

WARVI (W. N.) & RAWSON (R. W.). **Torula meningitis.**—*Arch. intern. Med.*, lxix, 1, pp. 90–98, 2 figs., 1942.

A case of fatal *Torula* meningitis [*Debaryomyces neoformans*: see preceding abstract] complicating Hodgkin's disease in a 39-year-old male patient at the Collis P. Huntington Memorial Hospital, Boston, Massachusetts, is fully reported, this being the eighth record of an association between the two maladies in question. A perusal of the relevant literature indicates that a diagnosis of torulosis is to be suspected in cases of otherwise inexplicable progressive intracranial disease, confirmation being obtained by studies of the spinal fluid, with identification of the fungus either by culture or animal inoculation, the latter method having been used by the authors. The organisms observed in process of budding in the leptomeninges of the patient measured 2 to 14 $\mu$ in diameter and consisted of a central round body and a mucoid capsule, the former staining orange and the latter blue with Mallory's aniline reagent.

BAKER (E. E.) & SMITH (C. E.). **Utilization of carbon and nitrogen compounds by Coccidioides immitis.**—*J. infect. Dis.*, lxx, 1, pp. 51–53, 1942.

In experiments at the Stanford University School of Medicine, San Francisco, the

following were among the carbon sources utilized by *Coccidioides immitis* [*R.A.M.*, xx, p. 577] on a basal medium consisting of 2 gm. each of primary and secondary potassium phosphates, 0·5 gm. magnesium sulphate, and 0·1 gm. ferric chloride in 1,000 c.c. distilled water: glucose, fructose, mannose, galactose, xylose, maltose, cellobiose, trehalose, $\alpha$-methyl glucoside, salicin, amygdalin, starch, dextrin, inulin, ethanol, glycerol, erythritol, mannitol, sorbitol, the acetate, propionate, caproate, lactate, pyruvate, succinate, fumarate, and malate of sodium, glycine, alanin, acetamide, and asparagin. Nitrogen was furnished by ammonium chloride, potassium nitrate, urea, acetamide, asparagin, glycine, alanine, glutamic acid, tyrosine, cystine, and peptone.

REID (J. D.), SCHERER (J. H.), HERBUT (P. A.), & IRVING (H.). **Systemic histoplasmosis.**—*J. Lab. clin. Med.*, xxvii, 4, pp. 419–434, 14 figs., 1942.

A full account is given of the clinical and mycological aspects of a fatal case of systemic histoplasmosis in a 38-year-old negro, a patient at the St. Philip Hospital, Richmond, Virginia, in whom the diagnosis was made during life by the isolation of *Histoplasma capsulatum* [*R.A.M.*, xxi, p. 255] from the blood (10 c.c. per flask) on a medium consisting of veal infusion broth with 0·3 per cent. dextrose, 0·5 per cent. sodium citrate, and 0·2 per cent. agar ($P_H$ 7·4). After 12 days' incubation at 37° C. the oval or occasionally circular yeast-like bodies appearing in large numbers were found on staining with Wright's reagent to be almost identical with, though slightly larger (2·7 to 3·6 $\mu$ in diameter) than those occurring in the tissue cells; they were occupied by a dark-staining, chromatin-like mass. Subcultures were made on Sabouraud's dextrose agar, dextrose extract agar, brain veal agar, and sealed brain veal blood agar slants in two series, one maintained at 37° and the other at room temperature. Growth developed first on Sabouraud's agar and dextrose extract agar at room temperature, the small, white, downy colonies gradually enlarging and producing white, feathery hyphae turning brown with age. Wet preparations from these colonies revealed a branched hyaline, septate mycelium, 2 to 5 $\mu$ in diameter, containing many dark, dancing granules, while smooth-walled arthrospores, 8 to 13 $\mu$ in diameter, were produced from stalks along the hyphae or at the ends of the branches. On sealed blood agar slants and in semi-solid media containing fresh blood at 37° the fungus tended to develop in the yeast-like stage, the gross appearance of the growth being of dull greyish-yellow colonies adhering firmly to the substance.

The experimental production of histoplasmosis in guinea-pigs is described, and the pathological morphology of the fungus in the case under observation discussed in relation to the differential diagnosis of the disease.

COHEN (V. L.). **The content of fungous spores in the air in Buffalo, New York.**—Abs. in *J. Bact.*, xliii, 1, pp. 115–116, 1942.

With a view to the establishment of a relationship between the identity and incidence of air-borne fungi [*R.A.M.*, xxi, p. 255] and (a) seasonal conditions, (b) fluctuations of atmospheric temperature and humidity at Buffalo, New York, Petri plates of Sabouraud's agar were exposed for half-an-hour at bi-weekly intervals throughout 1940, the cultures being determined and counted after three days' incubation at room temperature. Species of *Hormodendrum* were found to predominate from March to December, with a peak in July; *Alternaria* from May to December (August); *Penicillium* from March to May and October to December (April and November); *Phoma* from March to August and September to December (May and November); *Mucor* from February to July and August to December (April and November); *Fusarium* from June to November (August); *Phycomyces* from May to November (June); *Hyalopus* in January and February, especially the former; *Monilia* from June to September (July); and *Cephalothecium* [? *Trichothecium*] from January to March and October to December (February and November), while *Aspergillus* developed

sporadically throughout the year. No connexion was apparent between atmospheric fluctuations and the prevalence of the different organisms.

HEGGENESS (H. G.). **Effect of borax applications on the incidence of rust on Flax.**—*Plant Physiol.*, xvii, 1, pp. 143–144, 1942.

Further details are given on the control of flax rust (*Melampsora lini*) at the Minnesota Agricultural Experiment Station [*R.A.M.*, xxi, p. 256]. The disease was completely controlled by the application on 9th May, 1941, of borax at the rate of 60 lb. per acre. Zinc sulphate and calcium nitrate (30 and 120 lb. per acre, respectively), applied separately, not only failed to control the disease, but actually aggravated its severity, whereas in combination with borax (60 lb.) they gave absolute control. The same treatments were applied on 16th June with similar, though less markedly beneficial, results.

DUFRÉNOY (J.). **Changes in the structure of the cells induced by the 'yellow spot' virus disease of Easter Lilies.**—*Proc. La Acad. Sci.*, vi, p. 35, 1942.

The long epidermal cells of externally healthy Easter lily [*Lilium longiflorum*] leaves infected by the yellow flat [or rosette] virus [*R.A.M.*, xix, p. 517] reacted to treatment with the molybdenum blue stain by the differentiation of the mitochondria into flexuous threads, running parallel with the cytoplasmic strands radiating from the nucleus between some large vacuoles. In the shorter cells of the stunted, discoloured foliage affected by the disease, the mitochondria were disposed in rows of small rods along the cytoplasmic strands. The refringent honeycomb-like structure produced by this arrangement is thought to correspond to the 'X' or vacuolated bodies described by various workers engaged on the study of viruses.

WILSON (R. D.). **Black rot of garden Stocks.**—*Agric. Gaz. N.S.W.*, liii, 1, pp. 33–35, 55, 1 fig., 1942.

Black rot of garden stocks [*Matthiola incana*], stated to be caused by a strain of *Bacterium campestre* [*Xanthomonas campestris*], first recorded in New South Wales in 1938 [*R.A.M.*, xviii, p. 256], has become the most important disease of this popular ornamental plant found in the State, and one of the most serious with which commercial flower-growers have to contend. Seed-borne, the disease spreads with great rapidity under seed-bed conditions, and this spread, resulting from the use of diseased seed, is held responsible for the high percentage of infections observed during the past three years in many commercial plantings. Sowings made early in the season (December and January) are generally more seriously attacked than later ones, grown when the prevailing temperatures are lower.

Tests were carried out in which seed was submitted to different treatments, including (1) dusting with ceresan (UT 1875a) at the rate of 2 parts by weight to 1,000 parts by weight of stock seed, (2) dusting with excess ceresan and sieving off the excess dust, (3) dipping for 10 and 30 minutes in a 1 in 1,000 solution of mercuric chloride at room temperature, (4) hot-water treatment at 122° and 127·4° F. for 10 and 30 minutes and (5) treatment with bleaching powder (calcium hypochlorite) by four hours' immersion in a 7 per cent. solution at room temperature, 4, 16, and 24 hours' immersion in a 10 per cent. solution at room temperature, and four hours' immersion in a 10 per cent. solution at 61·7°, 68°, 77·9°, 86°, and 98·6°. Both the treated seed and the controls were sown either in outside seed-beds (in some instances the soil being sterilized with formalin) or in pots of steam-sterilized soil in a glasshouse.

The results obtained may be summarized as follows. The two ceresan dust treatments and the 10-minute hot-water treatment at 122° were ineffective. The two mercuric chloride treatments and the 10-minute hot-water treatment at 127·4° gave some control. The two 30-minute hot-water treatments and all the bleaching powder treatments gave considerable (possibly complete) control.

All the hot-water treatments severely affected germination. This effect was more

pronounced in the seed-beds than in the glasshouse. Injury was very marked on old seed. Thus, 30 minutes' immersion at 127·4° of three-year old seed gave only 8 per cent. germination, as against 49 per cent. for the control. On seed which was 1½ years old the same treatment under glasshouse conditions reduced germination to 66 per cent., as compared with 81 per cent. in the controls (average of three experiments). The 10 and 30 minutes' dipping in mercuric chloride reduced germination under glasshouse conditions to about the same extent as the hot-water method, but the effects were less severe outdoors.

The 16 and 24 hours' treatments in 10 per cent. bleaching powder solution at room temperature reduced germination to about 10 per cent. of that of the untreated seed. The four hours' treatment in 10 per cent. bleaching powder solution at 98·6° reduced germination from 83 per cent. (untreated) to 22 per cent.; none, however, of the other four hours' treatments had any seriously adverse effect, and provided the temperature of the liquid is kept below 86° it seems unlikely that serious effects would follow four hours' treatment in a 10 per cent. solution of bleaching powder.

The control measures recommended consist in the use of clean seed (directions for growing which are given), and of clean soil for the seed-bed (i.e., soil not previously bearing diseased stocks, or soil sterilized by heat or formalin), and crop sanitation; affected plants should be pulled up and burned, and land where diseased stocks have grown should not be planted again to this crop for at least four or five years. If the seed is of doubtful or unknown origin it should be treated for four hours in a 10 per cent. bleaching powder solution at a temperature not exceeding 85°. If practicable, the seed should be sown directly in the field, and not planted in a seed-bed.

Tompkins (C. M.) & Middleton (J. T.). **Root rot of Ranunculus asiaticus caused by Pythium debaryanum.**—*J. agric. Res.*, xliv, 3, pp. 179–183, 2 figs., 1942.

During the winter of 1937–8, Persian buttercups (*Ranunculus asiaticus*) in commercial field-plantings at Inglewood and Pacific Palisades, California, were observed to be affected by a destructive root disease. The disease was also found subsequently in Santa Cruz, San Mateo, and San Francisco counties.

The chief symptoms are general wilting and subsequent rapid collapse and death. The roots, tubers, stems, and petioles may all be infected. The roots and tubers of affected plants are dark brown, water-soaked, and flaccid. The stem plate is discoloured and dark, but not, as a rule, water-soaked or flaccid. Occasionally the petioles are attacked, the affected parts being dark brown, often with necrotic streaks 1 to 3 mm. wide, and about 30 to 60 mm. long, extending outwards from the base of the petiole, and parallel to its long axis. In the field, plants are generally affected when 6 to 8 in. high. The disease appears on widely different soil types, and is favoured by heavy rainfall or irrigation, poor drainage, cool weather, and overcrowding.

Isolations from affected material consistently yielded *Pythium de Baryanum*, the morphology of which is briefly described. Four isolates from different areas were studied. Their minimum, optimum, and maximum growth temperatures were, respectively, 1°, 28°, and 37° C. All four were pathogenic to healthy *Ranunculus* plants grown from seeds and tubers in inoculated soil, the incubation period ranging from 11 to 25 days; all the infected plants died a day or two after the foliage had begun to wilt. Of 20 plants inoculated with each isolate, none escaped infection, though the 20 controls remained healthy. The re-isolates were also highly pathogenic. The infected plants showed symptoms identical with those observed under field conditions.

In greenhouse tests on 46 species of plants the fungus was found to be pathogenic (no-wound technique) only to young plants of Iceland poppy (*Papaver nudicaule*), columbine (*Aquilegia caerulea*), fibrous-rooted begonia (*Begonia semperflorens*), butterfly flower (*Schizanthus pinnatus*), and cucumber. Control consists in the selection of well-drained sites for planting.

JOHNSON (F.). **The complex nature of White-Clover mosaic.**—*Phytopathology*, xxxii, 2, pp. 103–116, 2 figs., 1942.

It has recently been shown that white clover (*Trifolium repens*) mosaic is induced by a mixture of two distinct viruses, namely pea mottle and pea wilt viruses, the former alone being transmissible by dodder (*Cuscuta campestris*) and the latter infecting cowpea, which is resistant to mottle [*R.A.M.*, xx, p. 590]. A combination of the two viruses, transferred to peas induced symptoms of streak and killed the plants in the same way as the *Trifolium* virus 1 complex. Pea mottle virus alone caused a systemic mosaic disease in a number of pea varieties, and was further pathogenic to various plants in different families, e.g., *Stellaria media*, spinach, cucumber, sweet pea, lentil, lupin, lucerne, *Medicago lupulina*, *Melilotus alba*, *Phaseolus vulgaris*, *T. hybridum*, *T. incarnatum*, *T. pratense*, *T. repens*, broad bean, vetch, and *Antirrhinum majus*. Pea wilt, on the other hand, infected only members of the Leguminosae in a comparatively mild form and induced no mottling in peas, except for a very mild mosaic in Alaska and Canada White. No intracellular inclusion bodies were found in plants attacked by either virus, nor was transmission of the infective principle secured by the alternate feeding of the pea aphid (*Macrosiphum pisi*) on diseased and healthy pea plants.

The pea mottle virus succumbed to ten minutes' exposure to a temperature of 60° to 62° C., while the agent of wilt was inactivated by the same period at 58° to 60°. The infectivity of the pea mottle virus was maintained in a dilution of 1 part in 10,000 of water, the corresponding tolerance of wilt being in 1 in 100,000. Both viruses withstood ageing *in vitro* and in dried host tissues for a minimum of 31 days and were filterable through a Berkefeld W filter.

The names *Marmor efficiens* and *M. repens* are proposed for the pea mottle and wilt viruses, respectively.

GOULD (C. J.). **Diseases of cultivated Lupines.**—*Proc. Iowa Acad. Sci.*, xlvi (*1939*), pp. 119–125, 1940.

Brief accounts are given of the economic importance, geographical distribution and symptoms of eight major diseases of lupins, viz., (1) leaf spot (*Ceratophorum setosum*) [*R.A.M.*, xix, p. 99], (2) stem necrosis (*Ascochyta pisi* and other *A.* spp.), (3) damping-off and wilting (*Rhizoctonia* [*Corticium*] *solani*), (4) and (5) wilts due to *Sclerotinia sclerotiorum* and *Thielavia* [*Thielaviopsis*] *basicola* [ibid., xix, p. 657], (6) lime-induced chlorosis [ibid., xvi, p. 42], (7) sore shin (pea virus 2) [ibid., xv, p. 510 *et passim*], and (8) browning (cucumber virus 1) [ibid., xviii, p. 803], of which Nos. 2 to 5, inclusive, have been reported from the United States. Notes are also given on the essential features of ten minor disorders, among which may be mentioned *Collybia velutipes* and *Pleurotus ostreatus*, destructive wound parasites of *Lupinus arboreus*, a valuable soil retainer on sand dunes near San Francisco [ibid., xix, p. 658], and tomato spotted wilt, affecting lupins in the United States [ibid., xix, p. 657] and England. For the most part, the control measures advocated against lupin diseases are based on the use of resistant varieties.

FISCHER (G. W.). **Infection of forage grasses with flag smuts of Wheat, Rye, and grasses (Urocystis tritici, U. occulta, and U. agropyri, respectively).**—Abs. in *Phytopathology*, xxxii, 1, pp. 4–5, 1942.

The inoculation [? at the Washington Agricultural Experiment Station] of 32 species of *Agropyron*, *Elymus*, *Hordeum*, and *Sitanion* with spores of the wheat, rye, and grass flag smuts (*Urocystis tritici*, *U. occulta*, and *U. agropyri*, respectively), induced the development of typical symptoms as follows: *U. tritici* infected *Agropyron caninum*, *A. repens*, *A. spicatum*, *A. semicostatum*, *Elymus glaucus*, and *E. triticoides; U. occulta* attacked *A. caninum*, *A. inerme*, and *E. canadensis*; and *U. agropyri*

(from *Hordeum nodosum*) was pathogenic to *A. caninum* and *E. canadensis*. *U. tritici* and *U. agropyri*, being virtually identical in their morphological characters, should be regarded as races of the same species, to be designated, on grounds of priority, *U. agropyri*. A differential feature of *U. occulta* is the less complete investment of the spores by the sterile cells. The established susceptibility of grasses to wheat flag smut and the morphological identity of the wheat and grass pathogens afford a plausible explanation of the source of epidemics of *U. tritici* on wheat in the United States, where flag smut has long been known to involve a wide variety of grasses from coast to coast.

FISCHER (G. W.). **Comparative value of certain popular fungicidal dusts in control of head smut (Ustilago bullata) and in improvement of stands in forage grasses.**—Abs. in *Phytopathology*, xxxii, 1, p. 5, 1942.

Various dusts were tested at the Washington Agricultural Experiment Station for the control of smut (*Ustilago bullata*) [*R.A.M.*, xx, p. 536] on *Agropyron trachycaulum*, *Bromus marginatus*, *B. catharticus*, *Elymus canadensis*, *E. glaucus*, and *Hordeum nodosum*. Only 2 per cent. ceresan and new improved ceresan gave satisfactory results, the treated stands excelling the untreated checks by 300 to 500 per cent. The recommended concentrations for the two effective preparations are 2 to 4 and ½ to 1 oz. per bush. of seed, but no reduction in stand, except in the case of *H. nodosum*, followed their use in considerable excess (two to four times the appropriate strength).

ATKINSON (J. D.) & TAYLOR (G. G.). **Experimental spray work on the Havelock North orchard.**—*N.Z.J. Sci. Tech.*, A, xxiii, 1, pp. 9–12, 1941.

The results of further experiments (up to the season of 1940–1) fully confirmed those of tests already reported as regards the efficacy of the standard spray schedule of the (New Zealand) Plant Diseases Division for the control of apple black spot [scab] (*Venturia inaequalis*) and mildew (*Podosphaera leucotricha*) [*R.A.M.*, xxi, p. 144]. Pear scab [*V. pirina*], though less amenable to treatment than the corresponding apple disease, also showed signs of yielding to a systematic spraying programme.

MAGNESS (J. R.). **Apple varieties and important producing sections of the United States.**—*Fmrs' Bull. U.S. Dep. Agric.* 1883, 32 pp., 2 figs., 3 maps, 1941.

This bulletin comprises a brief review of the salient climatic and topographical features of the chief apple-growing sections of the United States, a discussion of the pathological agencies and conditions affecting the crop in the different districts under observation, and a description of the characteristics of the leading varieties.

HERMAN (F. A.). **Spray retention: amounts of arsenic and sulphur retained employing spray compositions.**—*Canad. Chem. Process Industr.*, xxv, 10, pp. 526–527, 1 graph, 1941.

At the Kentville Experiment Station, Nova Scotia, collections of leaves from 11 plots of 8 to 12 average-sized Stark apple trees were made immediately after the last treatment with a combined arsenic and sulphur spray (against insect injury and scab [*Venturia inaequalis*]), and at fortnightly intervals thereafter during the growing season. The initial reduction in the arsenic content of the foliage was rapid on the plots receiving the higher applications of flotation sulphur (15 or 20 lb. per 100 gals.), as well as where hydrated lime and calcium arsenate were constituents of the spray. In general, the reduction of residual sulphur was rapid during the first fortnight except in plot 13, treated with lime-sulphur (1 to 1½ gal.), iron sulphate (6 lb.), and white arsenic (½ to 1 lb.) per 100 gals., in which the drop was only from 151 to 136 mg. per 50 leaves, compared, e.g., with a fall from 115 to 44 mg. in plot 2, given 15 lb. ferrox flotation sulphur, 3 lb. calcium arsenate, and 6 lb. hydrated

lime. At the fifth collection on 6th September, the amount of sulphur (in mg. per 50 leaves) in plot 13 was 30, the corresponding figure for plot 2 being 11, and for plots 1 (1 gal. lime sulphur, 4 lb. magnetic catalytic sulphur, and 3 lb. lead arsenate), 4 (15 lb. Koppers flotation sulphur and 3 lb. lead arsenate), 5 (10 lb. magnetic '70' and 3 lb. lead arsenate), 6 (8 lb. flotox wettable sulphur, 1 pint orthex spreader, and 3 lb. lead arsenate), 8 (20 lb. ferrox flotation sulphur and 3 lb. lead arsenate), 9 (15 lb. ferrox flotation sulphur and 3 lb. lead arsenate), 10 (10 lb. ferrox flotation sulphur and 3 lb. lead arsenate), 11 (15 lb. ferrox flotation sulphur and 10 lb. black leaf 155), and 12 (15 lb. ferrox flotation sulphur and 3 lb. cryolite) being 16, 17, 54, 15, 48, 18, 17, 40, and 29, respectively.

The incidence of scab in plots 1, 2, 4, 5, 6, 8, 9, 10, 11, 12, and 13 was 0·53, 0·78, 0·6, 0·71, 0·86, 0·93, 0·73, 1·33, 1·65, 1·23, and 1·93 per cent., respectively, compared with 78·85 in the untreated control plot.

GERHARDT (F.). **Simultaneous measurement of carbon dioxide and organic volatiles in the internal atmosphere of fruits and vegetables.**—*J. agric. Res.*, lxiv, 4, pp. 207–219, 2 figs., 1 graph, 1942.

Using a method evolved by combining a modification of the extraction technique of Wardlaw and Leonard (*Ann. Bot., Lond.*, N.S., iii, pp. 27–42, 1939) for the removal of carbon dioxide from internal atmospheres with Gerhardt and Ezell's technique for the absorption of volatile atmospheres from stored fruit [*R.A.M.*, xx, p. 412], the writer found that the oiled paper (18·7 per cent. oil) employed in the wrapping of stored apples (Delicious variety in these tests) contained 35·37 mg. volatiles per wrap compared with only 3·82 mg. for plain paper. In other words, the oiled paper took up about ten times as much of the volatile emanations from the fruit as did the plain wrap.

Ripening processes induced a much greater change in the internal atmosphere of Bartlett pears than in that of Delicious apples. Severe scald developed in the pears after a week at 65° F. and may have been closely associated with a heavy increase in acetaldehyde during maturation. The soft-scalded tissues of Jonathan apples were found to contain slightly less carbon dioxide than normal ones, whereas the total volatile content of the former was some five times that of the latter. Other factors beside acetaldehyde accumulation must obviously be concerned in the multiplication of total volatiles in the soft-scalded tissues, since this compound comprises a similar percentage (13 and 16, respectively) of the total volatiles in both soft-scalded and sound tissue. In this connexion it may be noted that the development of off-flavour in Delicious and of soft scald in Jonathan apples was accompanied by copious accumulations of total volatiles, represented in the former case largely by acetaldehyde, whereas in the latter other types were involved.

BODINE (E. W.). **Antagonism between strains of the Peach-mosaic virus in western Colorado.**—Abs. in *Phytopathology*, xxxii, 1, p. 1, 1942.

Definite indications of antagonism between the several strains of the peach mosaic virus occurring in western Colorado [*R.A.M.*, xx, p. 370] have been observed. Thus, an Elberta tree affected by the slight strain, when re-inoculated with buds of the severe strain in the autumn of 1938, developed only slight strain symptoms in the following spring. After the insertion of buds from the re-inoculated tree into healthy Elbertas in the autumn of 1939, of the 18 successful grafts ten showed symptoms of the slight strain during the following spring, the remainder being very little or not at all affected. Ten of the inoculated trees, five with and five without definite slight strain symptoms, were re-inoculated with the severe strain in the spring and autumn of 1940. In the spring of 1941, each tree exhibited only the symptoms already shown in 1940. The remaining eight trees serving as controls likewise manifested the same symptoms as in 1940.

STODDARD (E. M.). **Inactivating in vivo the virus of X-disease of Peach by chemotherapy.**—Abs. in *Phytopathology*, xxxii, 1, p. 17, 1942.

In 1941, eight out of ten peach buds infected by the X-disease virus [*R.A.M.*, xxi, p. 28] failed to develop the symptoms of the trouble after immersion in quinhydrone as compared with one in the untreated controls and none in some of the other chemicals tested. A lesser degree of inactivation was obtained under comparable conditions by the use of 8-hydroxyquinoline sulphate, hydroquinone, paranitrophenol, calcium 8-hydroxyquinolate, urea, sodium thiosulphate, and some of their derivatives. For instance, to date, buds soaked in 1940 in urea, calcium 8-hydroxyquinolate, magnesium 8-hydroxyquinolate, ortho-nitrophenol, or sodium thiosulphate have remained healthy.

**Here are spray recommendations for orchards of western States.**—*Bett. Fruit*, xxxvi, 8, pp. 5, 23–25, 1941.

A conference of the Western Co-operative Spray Project held in Portland, Oregon, in January, 1942, reported, *inter alia*, that lime-sulphur (2 gals. to 100 gals. water) and ferric dimethyldithiocarbamate (1½ lb. plus 1½ lb. hydrated lime) have both given satisfactory control of cherry leaf spot [*Coccomyces hiemalis*] on sour cherries when applied at petal fall, shuck fall, and two weeks later.

SLATE (G. L.), SUIT (R. F.), & MUNDINGER (F. G.). **Raspberry growing in New York: culture, diseases, and insects.**—*Circ. N.Y. St. agric. Exp. Sta.* 153, 57 pp., 12 figs., 1940.

This circular, originally published in 1934, contains a section (pp. 22–48) on virus, fungal, bacterial, and physiological diseases affecting the raspberry crop in New York State [cf. *R.A.M.*, xii, p. 640], those of the first-named group being the most fully treated.

ATKINSON (H. J.) & WRIGHT (L. E.). **Studies on some Raspberry soils of British Columbia.**—*Sci. Agric.*, xxii, 5, pp. 287–297, 1942.

After referring to earlier investigations into raspberry failure in the Fraser River Valley, British Columbia [cf. *R.A.M.*, xii, p. 678; xvi, p. 47], the authors describe chemical studies made on nine samples of soil from areas in this locality in some of which raspberry growth had been good, while in the remainder it was unsatisfactory. The points dealt with included $P_H$ value, carbon and nitrogen content, available phosphorus, water-soluble phosphates and boron, water-holding capacity, exchangeable bases, displaced soil solution, proximate analysis of the organic matter fraction, and the effect of sterilization on most of these values.

Of all these factors, the only one that appeared to show a relationship with the level of raspberry growth was boron content. The samples from all the areas where raspberry growth was poor showed under 0·2 p.p.m. of boron, while those from all the good areas showed 0·25 p.p.m. or more; the sample from the one area marked 'excellent' showed the highest value of all, 0·37 p.p.m.

TIMS (E. C.) & BONNER (FRANCES). **Studies of Fig leaf blights.**—*Proc. La Acad. Sci.*, vi, pp. 13–34, 1 pl., 1942.

Three apparently distinct fungi responsible for fig leaf blights in Louisiana, namely, *Corticium stevensii*, *C.* (*Rhizoctonia*) *microsclerotia* [*R.A.M.*, xix, p. 294; xxi, p. 67], and an undetermined *C.* species were compared with *C. solani* and *C. koleroga* from coffee [ibid., xiv, p. 795]. In cultures on string bean agar, *C. stevensii* and *C. koleroga* grew relatively slowly, the average daily increase in the diameter of their colonies at the

optimum temperature of 24° C. being only 7·3 and 8·5 mm., respectively, as against 40, 45, and 35 mm., respectively, for *C. microsclerotia*, *C. solani*, and the unidentified *C.* sp. at their optimum of 28°. Many other cultural differences between the five species were observed on bean, potato dextrose, prune, onion, and Czapek's agars at 28°, but only a brief résumé of the results of these studies is given by the authors. Definitely organized sclerotia were produced only by *C. microsclerotia* and *C. stevensii*, *C. solani* and the undetermined *C.* sp. forming masses of irregular, somewhat flattened sclerotium-like aggregations, while *C. koleroga* developed no sclerotia but gave rise to an abundant mycelium ranging from oyster-white to beige or chamois-colour according to the substratum. The growth characters of the two closely related species, *C. stevensii* and *C. koleroga*, are presented in tabular form; the colour of the sclerotia of the former, which were most profuse on potato dextrose, prune, and onion agars, varied between beige and Italian straw.

In inoculation experiments on fig leaves under favourable conditions of warmth and humidity, all five species proved to be more or less destructive, especially the three faster-growing ones, which were capable of killing the foliage three days from the onset of infection. *C. stevensii* and the unidentified *C.* sp. formed basidial mats with spores on the lower surfaces of some inoculated leaves, the average length of the basidiospores of the former ranging from 10·4 to 10·8 and the width from 4·3 to 4·8 $\mu$, while the corresponding figures for the latter were from 7·5 to 8·7 and 4·5 to 5·5 $\mu$, respectively. The blunt, stout basidiospores of the undetermined *C.* sp. afforded an easy means of differentiation from the long and narrow ones of *C. stevensii*, but the other species produced basidia rarely or not at all.

The evidence accumulated in these investigations is considered to point to the maintenance of *C. koleroga* and *C. stevensii* as distinct species.

Further experiments in 1940 and 1941 with the mixture of 1·5 per cent. copper sulphate, 1 per cent. lime and zinc arsenite, 0·25 per cent. monocalcium arsenite, and 1 per cent. fish oil used in earlier trials [loc. cit.] gave fairly successful results, though considerable post-harvest defoliation was caused by *C. microsclerotia* and the undetermined *Corticium*.

**Successful stationary spray plant.**—*Fruit World, Melbourne*, xlii, 12, p. 6, 1 fig., 1941.

Brief details are given of an electrically driven stationary spray plant recently installed in one of the largest pear orchards in Victoria [cf. *R.A.M.*, xix, p. 295]. The pipes were reticulated from the mixing shed throughout the orchard to taps, from each of which a maximum of 35 trees is sprayed by means of 80 ft. of hose. The power for spraying is supplied by a 7½ h.p. electric motor. The power cost of spraying amounted to only 1s. 1½d. per 1,000 gals., as against a fuel cost of 3s. 4d. per 1,000 gals. for the old type with horse-drawn carts, the smaller figure also including the cost of pumping the water into the vats. Installation costs were £13 per acre.

HEUBERGER (J. W.) & TURNER (N.). **A laboratory apparatus for studying settling rate and fractionation of dusts.**—*Phytopathology*, xxxii, 2, pp. 166–171, 2 figs., 1942.

An apparatus is described for use in the study of the settling rate and fractionation of insecticidal and fungicidal dusts, features of which include a settling tower of simple design, an exposure chamber for the serial exposure of slides or leaves to the dust cloud in the tower, a dust magazine (charge tube) for the instantaneous and complete discharge of the test material by an air blast, and a convenient mechanism for the introduction of known charges of dust into the settling tower. Tables are given showing the consistency of the data thus obtained at the Connecticut Agricultural Experiment Station in exposures of 30 seconds with four copper dust mixtures, and of five seconds with four diluents, viz., aplite, Cherokee clay, pyrax ABB, and Volclay bentonite 200M.

Felix (E. L.). **Tetrachloro-para-benzoquinone, an effective organic seed protectant.**—Abs. in *Phytopathology*, xxxii, 1, p. 4, 1942.

In 41 greenhouse tests spergon, a commercial preparation containing 99 per cent. tetrachloro-para-benzoquinone as the active ingredient, was applied to peas [*R.A.M.*, xxi, p. 245] at a dosage of 0·25 per cent. of the seed weight. Ten days after planting the mean difference in stand was 52·9 per cent. and in plant height 0·85 cm. in favour of the treated samples. Active dosage of 0·125 per cent. of the seed weight in diluted and undiluted form yielded a somewhat thinner stand than the higher rate, though the plants of the former series were slightly taller. The efficacy of spergon was not impaired by the admixture of derris root containing 5 per cent. rotenone, indicating the apparent compatibility of the two disinfectants. Damping-off of cotton [*Pythium* spp., *Corticium solani*, and other fungi] was effectively combated in flats of Mississippi cotton soil by the treatment of machine-delinted seed at the rate of 3 oz. undiluted or 4 to 6 oz. 25 per cent. spergon in talc per bush. of seed.

Beasley (Elizabeth W.). **Effects of some chemically inert dusts upon the transpiration rate of yellow Coleus plants.**—*Plant Physiol.*, xvii, 1, pp. 101–108, 3 graphs, 1942.

In order to determine the effects of the chemically inert disinfectant dusts, Bancroft clay, fine and coarse talc, and silica, on the transpiration rate of plants, 90 potted *Coleus* plants, divided into four series, were treated with these preparations at the Texas Agricultural Experiment Station. The dusts were usually applied in the afternoon between 2 and 4 o'clock, and the weights of the plants were calculated morning and evening, before and after treatment, for a period of 10 to 14 days. Statistical analyses of the results indicated that normally the sole effect of the dusts is an increase in nocturnal water loss, and then only when the finer preparations (Bancroft clay and fine talc) are applied to the under, stomata-bearing leaf surfaces: the daytime transpiration rate was augmented only by Bancroft clay. The application of dusts to the upper surfaces produced no effect, and neither did treatments given at midnight, when the stomata are presumably closed. The loss of water through the agency of the dusts was chiefly significant among the younger and more tender plants, and it is considered unlikely that hardy field plants would suffer in this respect from the use of disinfectants of the type under observation.

Renn (C. E.). **Demonstration of Labyrinthula parasite in Eel-grass from the coast of California.**—*Science*, N.S., xcv, 2457, p. 122, 1942.

In a few areas of the Pacific Coast, marine eelgrass (*Zostera marina*) has of late undergone considerable wastage, and the author has recently demonstrated in specimens from North Humbolt Bay, California, and San Quentin Bay, Lower California, the presence of a species of *Labyrinthula* [*L.* (?) *macrocystis*] characterized by the same morphological features and unusual distribution in the newly invaded foliar tissue as that responsible for the depletion of the Atlantic eelgrass beds [and those of British Columbia: *R.A.M.*, xvii, p. 543; xix, p. 421].

Rayner (M. C[heveley]) & Levisohn (Ida). **The mycorrhizal habit in relation to forestry. IV. Studies on mycorrhizal response in Pinus and other conifers.**—*Forestry*, xv, pp. 1–36, 6 pl., 3 graphs, 1941.

In the second paper of this series of mycorrhizal studies [*R.A.M.*, xv, p. 737; xix, p. 36] an experiment was described in which three species of pine were submitted to soil treatments with different composts. The results now obtained show that in Wareham soil when direct inhibition of fungal activity is relieved, e.g., by compost action, mycorrhiza showing typical structure due to association with *Boletus bovinus*

become relatively numerous. Mycelium of this fungus is present throughout the area, and becomes active in mycorrhiza formation as the soil factors that inhibit fungal growth disappear. There is, therefore, small doubt that the poverty of mycorrhiza in untreated soil and the 'messy' or aberrant structure of most of them, are directly related to the action of these inhibiting factors. It must be assumed that the small amount of natural substratum accompanying the introduced mycelium suffices to maintain activity until the renewed vigour in root production and the ensuing mycorrhizal development bring about self-propagating soil changes advantageous to growth.

In other tests, control plots of *Pinus sylvestris* and *P. nigra* var. *calabrica* were inoculated with pure cultures of *B. bovinus* 14 months after sowing, with similar results to those in humus-inoculated plots. In both, individual seedlings or groups of seedlings of better colour and more vigorous growth appeared sporadically, the growth stimulus tending to spread thence throughout the plots.

The root systems of the seedlings in fungus-inoculated plots resemble those of plants in humus-inoculated soil, both differing strikingly from those of plants in control plots, in respect of colour, branching, abundance of mycorrhiza, and the comparative absence of aberrant structural features in individual mycorrhiza. Growth stimulus was slower in the pots inoculated with pure cultures.

If nutritional conditions for the seedling are directly associated with mycorrhizal activity, the observed impetus towards the production of root initials must precede stimulation due to this cause. Thus, the initial stimulus to root production and growth must be looked for in the surrounding soil. As it coincides with and radiates from points where inocula have been placed, it must originate in these inocula, and the conclusion follows that soil activities leading to the stimulation of plant growth are brought about by the introduction to seed-beds of suitable inocula, whether of soil, fragments of sporophore tissue, or pure cultures of specific mycorrhiza-formers.

Attempts to establish Sitka spruce [*Picea sitchensis*] from seed at Wareham having given unsatisfactory results, soil containing natural roots was obtained from Vancouver Island and Prince Rupert, on the Canadian mainland. Pot tests with Wareham soil were duplicated with a New Forest soil of similar origin but not infertile. Each set of experiments included three complete series, one receiving compost, the other two the same compost plus a 5 gm. inoculum of one or other Canadian soil. Controls were grown in each of the four soils, and other series included the addition of the same composts to the Canadian soils.

In the Wareham soil mycorrhiza of normal structure are absent, and most of the short roots were attacked by *Mycelium radicis atrovirens* and by a fungus resembling *Rhizoctonia sylvestris*. In the New Forest soil mycorrhiza of two kinds are formed as a result of association with *M. r. nigro-strigosum* and an unidentified Hymenomycete, but a high proportion of the rootlets were attacked by *M. r. atrovirens*. No *Rhizoctonia* attack was observed. In both Canadian soils mycorrhiza was formed by an unknown Hymenomycete, and in some cases by *M. r. nigro-strigosum*. The addition of compost in all cases produced marked stimulation of root and shoot growth, increased mycorrhizal activity, and reduction of fungal attack. Chlorosis occurred in the plants grown in Canadian soils or in soil inoculated with these soils, and this is ascribed to attack by two strains of *M. r. atrovirens* and a *R.* sp. resembling *R. sylvestris*, these fungi being imported in the soils from Canada. The need for caution in the empirical use of soil inocula for controlling mycorrhizal activities in seed-beds is thus emphasized.

A study of mycorrhizal response in Norway spruce (*Picea abies*), a species more refractory in Wareham soil than even Sitka spruce, was made in field plots and pot cultures receiving one of four different composts, or basic slag, or the same treatments with an added inoculum of Swedish soil at sowing: the results showed that there is an unidentified mycorrhiza-former for Norway spruce in the experimental area and it is suspected that *B. bovinus* may function in this way. Mycorrhiza formation is

completely inhibited in the untreated soil and comes into action slowly after treatment with composts or phosphatic manures. Absence of mycorrhiza is directly related to arrested growth and chlorosis in the experimental plants, and is believed to be a main cause of the similar behaviour of Norway spruce elsewhere in the area. The introduction of another mycorrhiza-former in soil from a Swedish stand facilitated mycorrhiza development and promoted growth in pot culture, but this beneficial effect was more than counterbalanced by the simultaneous introduction in the same soil of a strain of *M. r. atrovirens*, which was innocuous to the trees under native conditions, but deleterious in a new environment. Thus, further evidence is provided of the risk involved in the experimental use of soil or humus inocula in tree nurseries, if no attempt is made to define the conditions present in respect to mycorrhiza-formers or soil fungi known to be harmful to growth.

Investigation of the mycorrhizal equipment of Lawson's cypress (*Cupressus lawsoniana*), a native of the northern Pacific States of the American Union, showed that a fungus species able to form endotrophic mycorrhiza exactly resembling those found in this cypress in its native habitat is present in nursery soils in this country. It is not present in the soil of those parts of Wareham Forest where this tree has been sown or planted, and its appearance there was a legacy from the Oxford nursery where the trees were raised. Attention is drawn to the fact that a member of the vesicular-arbuscular group of mycorrhizal fungi [*Rhizophagus*: ibid., xviii, p. 470] capable of forming identical associations with roots of this tree is present in its native habitat and in British soil, and to the further fact that another member of the same group of fungi present in the mycorrhiza of *Molinia coerulea* throughout the Wareham area does not possess this ability. The observations made indicate that mycorrhizal association plays a critical part in the nutrition of this tree, and that the ability to form and maintain mycorrhiza is determined by soil conditions. The view that mycorrhizal association is a casual parasitism by certain soil fungi is completely at variance with these observations.

It is concluded that mycorrhizal association is a highly specialized aspect of the ecological balance normally maintained between the higher plants and their fungus competitors. Its real significance as an edaphic factor has been obscured hitherto.

DE TURK (E. E.). **Plant nutrient deficiency symptoms. Physiological basis.**—*Industr. Engng Chem.*, xxxiii, 5, pp. 648–653, 2 figs., 1941.

The following conclusions were reached as a result of the author's observations in Illinois in conjunction with a study of the literature on plant nutrient deficiency. The most common cases of malnutrition are those of deficiencies of one or more essential elements, which may be interpreted as excesses of the non-deficient elements. Deficiencies are relative, i.e., an adequate supply of a given element under one set of conditions becomes insufficient as other elements accumulate. Deficiency may be due to an insufficiency of the element in the soil; insufficient solubility rate; physiological unavailability, as in the failure of acid-sensitive plants, such as red clover [*Trifolium pratense*], to absorb calcium at a low hydrogen-ion concentration; and physiological unavailability within the plant itself, expressed as failure to reduce absorbed nitrate preparatory to protein synthesis.

Nutrient deficiencies give rise to many kinds of symptoms, which may be roughly grouped as follows: inhibited growth, no specific symptoms; colour changes, usually foliar; tissue necrosis, mostly in the leaves; and malformation of different organs. The symptoms are produced indirectly, resulting from a series of unbalanced physiological processes. Thus, a given symptom may follow upon more than one original cause; the purpling of young maize foliage, for instance, may be primarily due to phosphorus or nitrogen starvation, a series of cold nights and warm, sunny days, or transverse creasing of the leaves. Temperature, humidity, and other environmental conditions may modify the expression of deficiency symptoms in such a way that the

same lack in a particular crop may produce diverse external features in different geographical regions. On account of the complicated relations prevailing between plant maladjustments and the corresponding symptoms, the latter should, for the time being, be regarded rather as aids to, than as actual methods of, diagnosis.

Hollaender (A.) & Emmons (C. W.). **Wavelength dependence of mutation production in the ultraviolet with special emphasis on fungi.**—*Cold Spr. Harb. Symp. quant. Biol.*, ix, pp. 179–186, 8 graphs, 1941.

Recent developments in the study of the biological effects of ultra-violet radiation on micro-organisms are surveyed with special reference to the authors' investigations on the mutations induced by this agency on *Trichophyton mentagrophytes* [*R.A.M.*, xix, p. 215], including a forthcoming paper on the process of recovery from irradiation effects.

Quintanilha (A.). **Étude génétique du phénomène de Buller.** [A genetic study of Buller's phenomenon.]—*Bol. Soc. broteriana*, Sér. 2a, xiii (*1938–1939*), pp. 425–486, 9 diags., [? 1939. Received March, 1942.]

This is an exhaustive critical discussion of 'Buller's phenomenon' (the diploidization of a haploid mycelium or structure by a diploid mycelium) [*R.A.M.*, xx, p. 589] in the light of genetic studies by the author and others on various representatives of the higher fungi.

Melhus (I. E.), Shepherd (D. R.), & Corkle (Marie A.). **Diseases of Potatoes in Iowa.**—*Proc. Iowa Acad. Sci.*, xlviii (*1941*), pp. 133–146, 2 graphs, 1941.

The area under potatoes, one of the first crops planted in Iowa, increased from 18,124 acres in 1855 to 170,285 in 1895, after which there was a gradual decrease until 1930, when only 44,666 acres were allocated to the crop. From 1865 to 1925 the tendency of the yields was gradually downwards and that of prices generally upwards.

Late blight (*Phytophthora infestans*) has been of frequent occurrence, but was destructive only in the years 1858, 1865, 1866, 1869, and 1876, though the losses ranged from 6 per cent. to heavy in 1885, 1886, 1903, 1915, 1918, and 1924 also. Common scab (*Actinomyces scabies*), first reported in 1870, caused losses ranging from 10 to 20 per cent. in 1919, 1932, and 1934, and during the past five years has been very virulent in the alkaline peat soils in the north of the State. Black scurf (*Corticium vagum*) [*C. solani*], first observed in 1905, has been very troublesome throughout the State since the severe outbreak in Mitchell County in 1918. Early blight (*Alternaria solani*) has been serious several times since 1892, and in 1912 caused 15 per cent. loss. The first record of black leg (*Bacillus atrosepticus*) [*Erwinia phytophthora*] dates from 1905, when a 25 per cent. reduction in three counties was reported; the disease did not recur until 1918, since when it has been present almost every year, causing exceptionally heavy damage on the Early Ohio variety in 1928. Ring rot (*Bacterium sepedonicum*) was first detected in the State in 1939. Since the first record of mosaic in 1918, the disease has been prevalent, especially on Green Mountain and Bliss Triumph, causing a 12 per cent. reduction in yield in 1935. Other viruses present in the State include spindle tuber, curly dwarf, leaf roll, witches' broom, and calico. Greenhouse indexing of tubers for the elimination of viruses from home-grown seed was found to be impracticable under Iowa conditions. *Fusarium coeruleum*, *F.* [*solani* var.] *eumartii*, and other *F.* spp. are responsible for dry rot of stored tubers. Silver scurf (*Spondylocladium atrovirens*), which is common, but of little importance, on potatoes held as seed stock, was first collected in the State in 1917.

HILBORN (M. T.) & BONDE (R.). **A new form of low-temperature injury in Potatoes.**—*Amer. Potato J.*, xix, 2, pp. 24–29, 1 fig., 1942.

'Internal mahogany browning' is the name proposed for a disorder of potato tubers, due to protracted exposure to a medium-low temperature (32° F.), which affected the Chippewa, Katahdin, and Irish Cobbler varieties in several commercial storage houses in Maine in 1938. In experiments carried out during 1938, 1939, and 1940 under controlled temperature and humidity conditions, Chippewas and Katahdins stored throughout the winter at 32° developed the reddish-brown discoloration by March, no corresponding symptoms being apparent in the same varieties kept at 38° or in Green Mountains at 32°. Leaf roll aggravated the injury in Chippewa tubers, accentuating a greenish fluorescence characteristic of the trouble and so closely simulating that associated with ring rot [*Bacterium sepedonicum*: *R.A.M.*, xx, p. 549] as to be indistinguishable from it but quite distinct from the bluish fluorescence induced by brief periods of exposure to lower temperatures (21° to 27°). The yield reduction in Chippewas and Katahdins from planting seed severely affected by internal mahogany browning in a test in 1940 amounted to 54 and 24 barrels per acre, respectively, the corresponding figures for seed showing slight to medium discoloration being 22 and 4, but the presence in a seed stock of a small proportion of slightly diseased tubers is unlikely appreciably to impair its planting value.

KARMARKAR (D. V.) & JOSHI (B. M.). **Investigations on the cold storage of Potatoes.**—*Misc. Bull. imp. Coun. agric. Res. India* 45, 22 pp., 1 pl., 3 graphs, 1941.

Cold storage studies on potatoes of the Garwhal, Kahbrar, Mombasa, Malta Red Skin, Scotch Up-to-Date, Dunbar Cavalier, Carter's Long Keeper, and Khed (Italian White Round) varieties, carried out at the Ganeshkind Fruit Experimental Station, Kirkee, between 1936 and 1939 demonstrated that at temperatures under 35° F. dormancy was indefinitely prolonged. At 40° maximum dormancy was nine months, and delay in placing the potatoes at this temperature after harvesting reduced the dormancy period. No wastage occurred at 40° or 35°, but black heart [*R.A.M.*, xx, p. 593] developed after three and five months at 30° and 32°, respectively. The development of this defect was associated with increased respiration after the latter period. Sprouting vigour remained unaffected when the dormant period was extended at 35° or 40°; in some cases the growth and yield obtained from seed stored for long periods at these temperatures were improved. Tubers suffering from black heart did not sprout on removal to a temperature of 68°, but merely rotted away. Tubers stored in a state of immaturity were attacked by *Penicillium*.

KASSANIS (B.). **Transmission of Potato virus Y by Aphis rhamni (Boyer).**—*Ann. appl. Biol.*, xxix, 1, p. 95, 1942.

In glasshouse experiments, the aphid *Aphis rhamni* was found to be as efficient a vector of potato virus Y as *Myzus persicae* and to react to a preliminary starving period in the same way [*R.A.M.*, xx, p. 603]. In transmission tests from tobacco to tobacco (five insects used per plant) and from potato to potato (ten insects per plant), starved *A. rhamni* infected 22 out of 25 and 7 out of 10 plants, respectively (as compared with all plants infected by starved *M. persicae*), and unstarved *A. rhamni* infected 7 out of 20 and 3 out of 10 plants, respectively (compared with 7 out of 15 and none out of 5, respectively, infected by *M. persicae*).

MADARANG (S. A.). **Rhizoctonia damping-off of Cinchona seedlings.**—*Philipp. J. For.*, iv, 2, pp. 105–121, 2 pl., 2 figs., 1941.

The fungus isolated from *Cinchona* seedlings affected by damping-off in the Bureau of Forestry plantation, Bukidnon, Philippines, agreed in morphological and cultural characters with *Corticium vagum* (*Rhizoctonia* [*C.*] *solani*) [*R.A.M.*, xviii, p. 578].

Soil inoculation experiments gave positive results on *Cinchona succirubra* and Benguet pine (*Pinus insularis*), but not on potato or tomato, indicating the possible implication of a physiologic race of the pathogen. Soil sterilization either by steam pressure or formalin, applied at a dosage of 2·5 l. per sq. ft. of soil to a depth of 3 to 4 in. before sowing the seeds, is an effective measure against the form of damping-off under observation.

D'Oliveira (B.). **New hosts for the aecidial stage of Uromyces graminis (Niessl) Diet.**—*Bol. Soc. broteriana*, Sér. 2a, xiii (*1938–1939*), pp. 81–92, 2 pl., [? 1939. Received March, 1942.]

A tabulated account is given of cross-inoculation experiments in 1935–6 with *Aecidium foeniculi* from *Foeniculum vulgare*, growing near Lisbon, on a number of cultivated cereals and wild grasses, of which only *Melica ciliata* proved to be susceptible. Teleutospores from this host, readily identifiable as those of *Uromyces graminis* [*R.A.M.*, xx, p. 136], gave rise to a profusion of sporidia, which were inoculated with positive results into 15 species belonging to twelve different genera of the Umbelliferae, including carrot (a highly susceptible host, developing severe necrosis), *Coriandrum sativum*, and parsley. *F. vulgare*, however, was the only plant harbouring the aecidial stage of the rust in nature: it is commonly found growing in close proximity to *M. ciliata*, on which heavy infection of the foliage and stems occurs in the early summer. These results are considered to establish the genetic connexion between *A. foeniculi* and *U. graminis*. Evidence is briefly adduced from artificial nectarization tests of the heterothallic character of *U. graminis*.

Lucas (G. B.). **Deterioration of the red rot fungus in culture.**—Abs. in *Proc. La Acad. Sci.*, vi, pp. 46–47, 1942.

Cultures of *Colletotrichum falcatum*, the agent of red rot of sugar-cane, having been observed to 'run out' through failure to sporulate on bean agar, experiments were conducted to determine whether such deterioration is due to the lack of some substance provided by the original substratum or to a natural decline in the reproductive capacity of the fungus. Single spores from a profusely fructifying culture were transferred by means of a micro-manipulator to agar drops in Van Tieghem cells, and on germination again removed to Petri dishes containing the selected medium (Richards's or oatmeal agar). When the mycelium thus obtained sporulated in its turn, one of the spores was picked up and the process of transference repeated. By this method *C. falcatum* has been grown for nine generations on Richards's and for seven on oatmeal agar with no loss of vitality. Similarly successful results were secured by the transference of hyphal tips [cf. below, p. 306], 200 to 300 $\mu$ long, from an abundantly fruiting culture, first to water agar in a Petri dish, and then to oatmeal agar, the process being repeated as soon as the mycelium arising from the tip began to produce spores.

It would appear from the outcome of these trials that *C. falcatum* is possessed of an inherent faculty for spore formation permitting of its culture for an indefinite period on a suitable medium.

Bell (A. F.). **Report of the Division of Entomology and Pathology.**—*Rep. Bur. Sug. Exp. Stas Qd, 1940–41*, pp. 19–23, 1941.

In this report on sugar-cane disease work in Queensland during the period under review [cf. *R.A.M.*, xx, p. 230], the author states that gumming disease (*Bacterium* [*Xanthomonas*] *vasculorum*) was present in the Moreton, Mulgrave, and Hambledon Mill areas. At Moreton, infection was confined to the susceptible H.Q. 285, which is no longer on the approved list. As a result of the rapid elimination of S.J.4, the general situation in the Mulgrave district has much improved. In the Hambledon area, the disease has continued to spread in S.J.4, and no marked improvement can be looked for until this variety is no longer grown. In this locality, the Pompey

variety is also widely cultivated, but its susceptibility makes its retention as an approved variety doubtful. In a resistance trial concluded on 8th October, 1940, Q. 28, 28–4291, 31–2484, 32–8560, Improved Fodder, and China showed no dead stalks and no oozing gum from the living stalks whereas H.Q. 426, 1900 seedling, H.Q. 458, and Pompey showed, respectively, 60 and 50 per cent., 10 and 30 per cent., 10 and 20 per cent., and 20 and 45 per cent., the corresponding percentages for D. 1135, Q. 29, and Q. 44 being 0 and 15, 0 and 4, and 0 and 2.

The chief sugar-cane disease in Queensland is still downy mildew (*Sclerospora sacchari*) [ibid., xx, p. 277], which occurred in the Cairns, Mackay, and Bundaberg areas. Owing to the vigilance of the Disease Control Boards [ibid., xxi, p. 44], the small outbreaks in the Cairns district were kept within bounds. Eradication orders were issued to two farmers in the Mulgrave and five in the Mossman area. In the Hambledon Mill area, only four affected stools were found on one farm. In the Mackay district, the position is improving as a result of the non-approval of P.O.J. 2878, the issue of eradication orders, and the activities of the Disease Control Boards.

Other work on this disease demonstrated that *Erianthus arundinaceum* exposed to heavy infection remained free from attack, whereas maize plantings made on 7th November all became diseased, stunted, and malformed within a month, though in a planting on 3rd October no sign of disease was observed until 5th December, when the plants were about 4 ft. 6 in. high. Later, two-fifths of the early plot became affected, but little malformation developed, and grain production remained normal. The later-sown plot, on the other hand, failed to produce any grain. Attempts at seed transmission were unsuccessful, as were efforts at direct infection of young leaves by enclosing them in tubes with affected leaves *in situ*. From 1st September until 15th October minimum daily temperatures ranged from 48·2° to 64° F., but only on five occasions did the figure exceed 60°, though the midnight temperature rose above 60° on 14 occasions. Sporulation was first noted on the morning of 16th October, following a temperature of 64° at midnight. After this, minima were always over 60°, and on one occasion the figure reached 68°. Sporulation was slightly irregular immediately after 15th October, but quickly became copious. These observations support others made in the laboratory which indicated that the minimum temperature for sporulation is about 60°. Oospores exposed in trash or soil, or treated with germination stimulants, failed to germinate. Further tests with warm-water treatment resulted in the production of healthy plants from diseased setts treated at 54° and 56° C. for 20 and 10 minutes, respectively, though germination after treatment was only fair. Treatment for 10 minutes at 54° appeared to be just on the border line of effectiveness.

Routine resistance trials carried out at Cairns showed that Q. 20, Q. 36, Q. 39, Q. 813 (standard), Atlas, Cato, Comus, Venus, S.C. 12/4, E.K. 28, Kassoer, *Saccharum spontaneum* Tank., *S. spontaneum* Burma, and *E. arundinaceum* were moderately resistant, while Neptune was highly susceptible. At Bundaberg, 28–4291, 31–2484, 32–8560, B. 726, Co. 281, P.O.J. 2725, Q. 28, Q. 43, Q. 45, G. 10, G. 48 (Mackay), H. 18 (Mackay), China, and Improved Fodder (Meringa) showed no infection; B. 2935, Co. 290, Glagah, Q. 813, 30 R. 115, 30 G. 1250, 29 G. 706, G. 34, H. 16, I. 6, I. 9, I. 11, I. 15, I. 27, I. 31, I. 35, I. 41, H. 45 (Mackay), and H. 63 (Mackay (showed 0 to 10 per cent. infection; P.O.J. 2878, Q. 25, and 30S.N.362 showed 10 to 20 per cent.; Marcus, P.O.J. 213, 31–1389, G. 16, I. 38, and I. 39 showed 20 to 40 per cent.; 32G. 1374, 33S.N. 1270, I. 25, I. 46, and I. 62 40 to 60 per cent.; and Co. 364 and I. 64 over 60 per cent. infection. The apparently high resistance of Glagah (three diseased shoots in a total of 537) indicates that the susceptibility of P.O.J. 2878 and other high-numbered P.O.J. canes does not derive from *S. spontaneum.* This view is confirmed by the behaviour of the two *S. spontaneum* canes in the Cairns trial.

Leaf scald (*Bacterium albilineans*) [ibid., xx, pp. 231, 291, 424] continued to be of economic importance only in the very wet area between Gardonvale and Babinda. In resistance trials, the canes are inspected at fixed intervals and the newly diseased

stools marked with a distinguishing peg, so that it can be ascertained at a glance when the symptoms became apparent. At the final examination, a note is taken of the diseased stools that appear to have recovered, so that the tolerance of each variety may be estimated. In a routine resistance trial in the very wet area mentioned Atlas, Badila, B. 726, B. 2935, C.P. 29/116, C.P. 807, Cato, Comus, D. 1135, H.Q. 409, H.Q, 426, Korpi, Marcus, Oramboo, Q. 20, Q. 25, and 31–1389 showed, respectively, 3, 39. 39, 4, 0, 0, 24, 6, 0, 31, 78, 50, 13, 33, 23, 3, and 14 per cent. diseased stools. Atlas, Badila, and Oramboo were tolerant, H.Q. 426 fairly so, and Cato, H.Q. 409, and Korpi recovered. H.Q. 426 was the most adversely affected.

The position with regard to Fiji disease [ibid., xx, p. 230] improved in the Bundaberg area, and infection remained at its previous low level at Isis. Strict control of varieties and systematic inspections by the local Cane Disease Control Board have assisted in reducing infection in the Maryborough district, and a partial return to the cultivation of susceptible varieties should soon be practicable in this area. The improved situation in the Logan district has permitted the approval of P.O.J. 2878. In a varietal resistance trial, though infection was too light to allow specific conclusions, Q. 25 was even more susceptible than P.O.J. 2878, while Q. 27 appeared to be quite resistant.

To ascertain whether exposure of cane setts to the sun would control chlorotic streak [ibid., xx, p. 231], setts of Badila on a sheet of galvanized iron were exposed to direct sunlight for six hours. The internal sett temperature ranged from 43° to 47° C. for the different setts. After exposure, the setts, together with the unexposed controls, were soaked overnight and planted. Six months later, only 20 per cent. of the stools from the exposed setts were affected, as against 90 per cent. for the controls, the former also appearing much the more vigorous.

Drought during the spring of 1940 was succeeded by a very long wet season during which normal weed eradication was impracticable. Large populations of *Aphis maidis* resulted in the spread of mosaic being more rapid than usual, especially in the Bundaberg area, where Q. 25 became infected. It is expected that the position will right itself when conditions again become normal.

MUNDKUR (B. B.). **Notes on Saccharum and Erianthus smuts.**—*Kew Bull., 1941*, 3, pp. 209–217, 1942.

In a critical study of 18 species of the ovariicolous smuts on species of *Saccharum* and *Erianthus* [cf. *R.A.M.*, xix, p. 237] the author found that *Ustilago pulverulenta* belongs to the genus *Cintractia*, and the name proposed by Cooke and Massee, *C. pulverulenta*, is retained after examination of the type specimen. The host was redetermined by N. L. Bor as a species of *Saccharum*. The smuts determined by Sydow as *C. pulverulenta* and by Boedijn as *U. pulverulenta* are *U. courtoisi* Ciferri. *U. erianthi* Sydow is transferred to the genus *Sphacelotheca*. *Sorosporium indicum* n. sp. is described on *Saccharum munja*. Examination of type material of both *Ustilago sacchari* Rabenh. and *U. sacchari-ciliaris* Bref. showed these species to be identical, the correct name for the fungus being *Sphacelotheca sacchari* (Rabenh.) Ciferri. A smut on *E. capensis* from South Africa is thought to be an undescribed species of *Tilletia* but insufficient material was available to enable a final decision to be reached. A revised description is given of *U. microthelis* Syd. based on a study of type material of this Brazilian species on *E. asper*; the spores measured 7·9 to 12·6 (mean 10·5) $\mu$. All species mentioned occur in India except the two last-named.

RYKER (T. C.). **Loss of sporulation in Cercospora.**—Abs. in *Phytopathology*, xxxii, 1, p. 16, 1942.

Cultures of certain species of *Cercospora*, originating either in the host tissues or from single spores, have been observed ultimately to produce feebly sporulating

mycelial variants, usually white and devoid of conidia, which overrun the substratum. It is, however, possible to maintain the original type by transference from hyphal tips or conidia. The white variant, which remains fixed, has been found, from a study of 38 single hyphal-tip isolates of germinating conidia, to appear in *C. oryzae*, *C. beticola*, *C. apii*, and *C. nicotianae*. Since the conidial cells are uninucleate, the variants are presumed to be mutations. The loss of sporulation in cultures of the species of *Cercospora* under observation is ordinarily due to the suppression of the original cultures by non-conidial variants.

SNYDER (W. C.) & HANSEN (H. N.). **The importance of variation in the taxonomy of fungi.**—*Proc. sixth Pacif. Sci. Congr.*, iv, pp. 749–752 [? 1940].

In discussing the importance of natural variation in the taxonomy of fungi the authors distinguish between polymorphic, cyclogenic, Mendelian, temporary, and apparent variations, and mutations. The first includes all distinct morphologic phases of development that a fungus may exhibit in nature, under the proper conditions. An example occurs in *Leptosphaeria pratensis* [*R.A.M.*, xviii, p. 320]. One morphologic stage is *Stagonospora*, another *Phoma*, and these imperfect stages have been variously described as *Ascochyta*, *Septoria*, *Marssonia*, *Diplodina*, *Phleospora*, etc., and as different species in these genera. Cyclogenic variation is a particular type of polymorphic variation, in which the stages follow one another in a definite succession. This type is seen in the rusts, e.g., *Puccinia graminis*. The significance of Mendelian or inherent variation in taxonomy is well illustrated in the rusts, notably in *P. graminis*, and in the smuts, where it occurs in a number of morphological types and a wide range of physiologic races; further, Mendelian segregants from imperfect stages of fungi with undiscovered sexual stages in nature are often wrongly described as distinct fungi. Temporary variations include profound differences in taxonomic features, and a good example has recently been described [ibid., xviii, p. 609]. Apparent variations include those resulting from impure culture, those caused by disease, and those due to heterocaryotic mixtures or combinations of closely related forms. Mutation variations may differ widely from the parent, and constitute a real problem.

To serve its purpose, a taxonomic scheme must be based on (1) a knowledge of the range of variability of each fungus treated, morphologically, and, where important, physiologically; (2) a knowledge of the morphological characters common to all the variants, upon which to formulate the morphological species limits; (3) a knowledge of the biological characteristics of the species or the individuals comprising it; and (4) a standardized technique enabling any worker anywhere to achieve the proper determination of his species with a minimum of effort and a maximum of accuracy.

SYDOW [H.]. **Mycotheca germanica Fasc. lxv–lxviii (No. 3201–3400.)**—*Ann. mycol., Berl.*, xxxviii, 5–6, pp. 453–484, 1940.

Included in this critically annotated list of exsiccata of fungi published by the author in periodical instalments may be mentioned, in addition to a new genus *Chondrostroma*, with its type species, *C. laricis*, on larch (*Larix sibirica*) near Siegen [Westphalia] and four other new species, *Puccinia pumilae-coronata* H. Paul, with its aecidial stage on *Rhamnus pumila* in the Bavarian Alps; *P. sesleriae* Reich., with its aecidial stage on *R. saxatilis* in the neighbourhood of Vienna; *Mycosphaerella microsora* n. sp., the perfect stage of *Cercospora microsora*, on dead lime (*Tilia parvifolia*) leaves; and a *Septoria* on wheat assigned by R. Sprague to a morphological variety of *S. nodorum* characterized by multiseptate spores besides the ordinary uni- to triseptate ones, the average dimensions of the (?) German material being 20 to 35 by 2·5 to 3·5 $\mu$ compared with 16 to 32 by 2·2 to 3·5 $\mu$ for North American specimens.

SHEFFIELD (F[RANCES] M. L.). **Presence of virus in the primordial meristem.**—*Ann. appl. Biol.*, xxix, 1, pp. 16–17, 1942.

The fact that no intracellular inclusions have ever been found in the primordial meristem of virus-infected plants led the author to test experimentally whether viruses are capable of penetrating into the growing point. Water suspensions of meristematic tissue dissected from apices of shoots and roots of tobacco plants infected with tobacco mosaic and tomato plants infected with tobacco mosaic or aucuba mosaic viruses produced lesions in each case when inoculated into *Nicotiana glutinosa* leaves. These results are taken to indicate that virus is present in the primordial meristem and it is concluded that the absence of intracellular inclusions must be attributed to some other causes. Similar tests with apical meristems from roots and shoots of tomato plants infected with severe etch virus gave negative results, but the failure is believed to be due to the fact that the inoculum was too dilute (the virus content of sap from plants infected with severe etch is only about one-thousandth of that from tobacco plants with mosaic) rather than to the absence of virus in the tissue.

WYND (F. L.). **Certain enzymatic activities of normal and mosaic infected Tobacco plants.**—*J. gen. Physiol.*, xxv, 4, pp. 649–661, 3 graphs, 1942.

At the University of Illinois, Urbana, the writer inoculated five-leaved Burley tobacco plants in the lowest leaf remaining after the removal of the two basal leaves with the virus of tobacco mosaic, expressed from severely diseased foliage, and followed the activities of oxygenase, peroxidase, catalase, and invertase in infected and normal leaves of comparable age at two- to three-day intervals over a period of three weeks. The inoculated leaves exhibited a great decrease relative to normal tissue in the activity of oxygenase and peroxidase on the sixth day, followed by an abrupt rise from the 14th to the 18th, and then by another decline. The increased activity of catalase reached a maximum about the eighth day, with a secondary peak on the 16th to 18th. Invertase sank to a minimum, compared with normal plants, about the eighth day, and again on the 16th to 18th.

FRAMPTON (V. L.). **On the size and shape of the Tobacco mosaic virus protein particle.**—*Science*, N.S., xcv, 2461, pp. 232–233, 1 graph, 1942.

The author, discussing recent studies on the shape and size of the tobacco mosaic virus protein particle, points out that Stanley and his co-workers seem to regard aggregation as of little significance. They hold that conclusions reached as to the size and shape of the protein particles from ultracentrifuge and viscosity studies are valid and accurate; they cite electron microscope photographs as substantiating evidence, and from them conclude that the length of the protein molecule is 280 m$\mu$ [*R.A.M.*, xx, p. 428], though the photographs show many particles which are much shorter than this. Measurements from photographs are not very accurate; it is impossible to be sure, for instance, that all the particles are lying flat. A length distribution curve for 159 particles in photographs published by Stanley and Anderson indicates length classes of 300, 190, 150, 100, and 37 m$\mu$, essentially in the ratio of 8 : 5 : 4 : 3 : 1, which clearly implies orderliness. When Melcher and his co-workers found in their photographs particles the lengths of which were predominantly in the neighbourhood of 140 and 190 m$\mu$, Stanley and Anderson concluded that they were photographs of different strains of the virus [loc. cit.], but the same lengths occur in the photographs published by Stanley and Anderson [loc. cit.]. It is also pointed out that the size of the suggested basic unit agrees well with the diameter of some 38 m$\mu$, arrived at by Thornberry from ultrafiltration experiments [ibid., xiv, p. 721].

VALLEAU (W. D.). **Breeding Tobacco for resistance to mosaic.**—Abs. in *J. Bact.*, xliii, 2, p. 272, 1942.

Two types of resistance to mosaic have been utilized in the breeding of Burley

tobacco [*R.A.M.*, xxi, p. 227], one, occurring in the Ambalema variety, apparently representing true resistance. This type is governed by at least two recessive Mendelian factor pairs, and the use of successive resistant selections for back-crossing with Burley has produced strains of the latter combining good quality with a high degree of resistance. The other type of resistance, derived from *Nicotiana glutinosa*, is characterized by a localization of the virus in the necrotic spots formed at its sites of entrance. The back-crossing of a fertile hybrid between *N. glutinosa* and *N. tabacum*, followed by back-crossing with Burley or successive resistant selections, resulted in the isolation of several homozygous resistant strains of Burley closely resembling but not identical with the Burley parent. Apparently a group of genes of *N. glutinosa*, besides the necrotic spotting factor, are retained in these hybrids after five consecutive back-crosses. Strains of Burley have also been developed carrying both types of resistance.

Allington (W. B.) & Johnson (J.). **The relation of potassium to water-soaking of Tobacco.**—Abs. in *Phytopathology*, xxxii, 1, p. 1, 1942.

Further investigations were made at the Wisconsin Agricultural Experiment Station on the physiological water-soaking of tobacco plants in relation to wildfire (*Bacterium tabacum*) [*Pseudomonas tabaci*] and blackfire [angular leaf spot] (*Bact. angulatum*) [*P. angulata*: *R.A.M.*, xix, p. 124]. It was shown that incipient or actual potassium deficiency enhanced susceptibility to the disturbance, which on the other hand scarcely affected plants with ample reserves of the mineral, except under conditions of high relative humidity and low light intensity. The liability to water-soaking of potassium-deficient plants is accompanied by susceptibility to bacterial infection. A shortage of potassium in the foliar tissue is known to induce extensive cellular necrosis, which may account for the special prevalence of water-soaking in the living areas surrounding such foci.

Diachun (S.), Valleau (W. D.), & Johnson (E. M.). **Isolation of Bacterium angulatum from overwintered Tobacco field soil.**—Abs. in *Phytopathology*, xxxii, 1, pp. 2–3, 1942.

To ascertain whether *Bacterium angulatum* [*Pseudomonas angulata*] is present in the overwintered soil of tobacco fields [in Kentucky], samples of such soil were mixed with sterile water and poured over the lower surface of susceptible tobacco leaves. The leaves were artificially water-soaked [see preceding abstract] by means of a strong jet of water from a hypodermic syringe just before inoculation in order to promote the ingress of the bacteria present on the leaf through the stomata. Between 2nd November, 1940, and 18th April, 1941, *P. angulata* was recovered from field soil in which naturally infected tobacco had grown during the previous summer, being isolated from 37 out of 182 samples on nine out of 15 dates.

Morgan (W. L.) & Hely (P. C.). **Combined sprays for late Tomatoes.**—*J. Aust. Inst. agric. Sci.*, vii, 4, pp. 158–161, 1941.

In a test conducted at Mangrove Mountain, New South Wales, Pritchard tomatoes were sprayed nine times between 18th February and 24th April, 1941, as follows: (a) Bordeaux mixture (1–1–20) plus nicotine sulphate (1 in 400), (b) Bordeaux mixture (1–1–20), (c) copper oxychloride (1 lb. in 40 gals.) plus nicotine sulphate, (d) as (c) plus hydrated lime (1 lb. in 40 gals.), (e) Bordeaux mixture (1–1–40) plus nicotine sulphate, and (f) Bordeaux mixture (1–1–10) plus nicotine sulphate. The nicotine sulphate and hydrated lime were used only on two occasions, and lead arsenate was included in all the sprays.

The plants sprayed with (a) gave larger yields than any others, both in total weight of marketable fruit and in total number of fruits harvested. The yield of marketable fruit in pounds was significantly greater in this treatment than in (b) or (f). The

difference between (e) and (a) was substantial, amounting to 11 per cent. Significantly smaller numbers of fruit were harvested after treatment with (a) and (b) than with (e) and there was no significant difference in yield of marketable fruit or total numbers of fruits harvested between the copper oxychloride plots (c and d) and the (e) plots. The lowest yield of marketable fruit and the smallest total number of fruits harvested came from the plots treated with (f). The smaller numbers of fruits and the low yield from the strong Bordeaux plots are attributed almost entirely to the destruction of blossom buds, flowers, and young fruits by the spray.

The percentage of marketable fruits was significantly less in the copper oxychloride plots than in any of those treated with Bordeaux mixture, largely owing to heavier infection with early blight (*Alternaria solani*) on the fruits sprayed with copper oxychloride. There was no significant difference in the percentage of marketable fruit between the weak and strong Bordeaux mixtures.

The amount of early blight on the fruit at harvesting was significantly least in the plots sprayed with Bordeaux mixture (1–1–10). It was significantly lower where Bordeaux mixture (1–1–20) was used without nicotine sulphate than where Bordeaux mixture (1–1–40) or the copper oxychlorides were used. However, the plants sprayed with Bordeaux mixture (1–1–40) did not show significantly more early blight on the fruits than those sprayed with Bordeaux mixture (1–1–20) plus nicotine sulphate. All the plots sprayed with Bordeaux mixture were significantly freer of early blight than the two copper oxychloride treatments.

R. D. Wilson reported that the various strengths of Bordeaux mixture and copper oxychloride were all of some value in controlling foliage infection by early blight, though in no instance was control complete. In this respect, copper oxychloride was the least effective treatment. No appreciable injury was caused by copper oxychloride and Bordeaux mixture (1–1–40), but the two higher concentrations of Bordeaux mixture were injurious. Taking into account both spray injury and early blight control the best results were given by the Bordeaux mixture (1–1–40).

**Prevention of spotted or bronze wilt of Tomatoes.**—*Agric. Gaz. N.S.W.*, liii, 1, p. 32, 1942.

Promising results in the control of tomato spotted wilt are being obtained at Hawkesbury Agricultural College by spraying the plants from the very early seed-bed stage onwards with a solution of 2 oz. tartar emetic and 4 oz. sugar in 4 gals. water [*R.A.M.*, xx, p. 282], which acts as a poison bait for insect vectors. In the unsprayed plots over three times as many affected plants were found (by the second week of picking) as in the plots sprayed twice a week, and over $2\frac{1}{2}$ times as many as in those sprayed once a week. For seed-bed use, growers are recommended to prepare a stock solution of 1 oz. tartar emetic in 1 qt. water. To 4 fluid oz. of the stock solution water is added to make up to 32 oz., together with a teaspoonful of sugar. The spray may be conveniently applied to seedlings or small plots of tomatoes by means of a 'fly sprayer'. A fine mist is required, and for reasons of economy the nozzles of spray pumps should be reduced in size for field applications.

Haynes (W. C.). **Mold count as an index to quality of Tomato juice.**—*Canning Age*, xxii, 9, pp. 438–439, 458, 1 fig., 1941.

Attention is drawn to the advisability of the employment of an experienced analyst in New York State tomato-canning plants, thereby preventing heavy losses through the Federal and State embargo on mould-contaminated produce. The expense of such employment is stated to be negligible in comparison with the reduction of profits entailed in the confiscation of even a single shipment. For the benefit of students brief notes on the technique of examination are included.

HESTER (J. B.). **Boron and manganese in Tomato production.**—*Amer. Fertil.*, xcv, 7, pp. 5–8, 24, 26, 4 figs., 1941.

Symptoms of boron deficiency in tomatoes have been observed by the writer in various parts of the United States and Canada. Tests carried out by a special technique, using sunflower as an indicator plant, on 839 soil samples from New Jersey and eastern Pennsylvania revealed varying degrees of insufficiency of this element in 18 per cent. of the samples, notably the lighter types with an acid reaction. Field experiments on the practical application of these data to the control of the deficiency symptoms in tomatoes are in progress, pending the conclusion of which the addition of 5 lb. borax to each ton of fertilizer is recommended.

Manganese deficiency has been found to lead to a low vitamin C content of tomatoes.

HEPTING (G. H.). **Reducing losses from tree diseases in eastern forests and farm woodlands.**—*Fmrs' Bull. U.S. Dep. Agric.* 1887, 22 pp., 9 figs., 1942.

In this bulletin the author has brought together the chief items of information on tree diseases significant in the eastern and southern parts of the United States [cf. *R.A.M.*, xviii, p. 827]. Decay, pruning, cankers, leaf diseases, epidemic killing diseases, and the deterioration of logs and lumber are discussed from the standpoint of the small landowner, suggestions being given for control where feasible. Most of the points dealt with have already been noticed [ibid., xviii, pp. 280, 827, *et passim*].

HARRIS (M. R.). **The behavior of Endothia parasitica on Chestnut trees in California** —Abs. in *Phytopathology*, xxxii, 1, p. 7, 1942.

Three chestnut groves in San Joaquin County, California, have been found infected by *Endothia parasitica*, the observed presence of which dates in one case from 1938 and in the two others from 1934. The origin of the fungus is not known, but it is believed to have been introduced on scions from the eastern States. The blight lesions are most prevalent at or below soil-level. The perfect stage of the organism has not yet been detected locally, but pycnidiospores, carried by irrigation water, have been shown to be largely responsible for the spread of infection, while contaminated pruning tools are occasionally implicated. Promising indications of the ultimate eradication of the parasite have been obtained by inspection, twice a year, of the affected groves and destruction of diseased trees.

MILLER (P. W.). **Current investigations on the control of Filbert and Walnut blight.**—*Rep. Ore. St. hort. Soc., 1941*, pp. 120–123, 1942.

In further spraying tests against filbert [*Corylus avellana*] blight (*Phytomonas corylina*) [*R.A.M.*, xx, p. 40] in Oregon, bud and twig infection was reduced from 15·2 to 1·4 per cent. in a 12-year-old Barcelona filbert orchard by one application of Bordeaux mixture (8–4–100) plus Grasselli spreader-sticker (1 oz. per 100 gals.). In another orchard, three applications of Bordeaux mixture (8–4–100) in late summer, late autumn, and early spring reduced bud and twig infection from 16·3 to 1·9 per cent., a single application in late summer reducing it to 3·1 per cent.

In normal seasons one application of Bordeaux mixture (8–4–100) plus a wetting agent applied in late summer before the first rain falls will hold the disease in check. When the autumn and winter are exceptionally wet a further application in late autumn (when the leaves are about three-fourths off the trees) and another in early spring (when the leaf buds begin to open) may be necessary.

Tests against walnut blight [*Xanthomonas juglandis*: ibid., xx, p. 237], which during 1941 reached epidemic proportions in Oregon, showed that both copper oxalate and yellow cuprous oxide were highly efficacious and caused little if any foliage injury. In one orchard, 20 per cent. copper oxalate (3–100), yellow cuprous oxide (2–100), and

Bordeaux mixture (6–2–100), applied in the early, middle and late pre-bloom, and early post-bloom stages reduced infection from 53·7 to 2·9, 2, and 1·7 per cent., respectively. Small-scale tests can now be made by growers who desire to do so with yellow cuprous oxide; it should be used at the rate of 2 lb. per 100 gals. water, with a good adhesive.

In another test, infection was reduced from 53·7 to 4·3 per cent. by four applications of a dust composed of 10 per cent. yellow cuprous oxide, 15 per cent. micro-sulphur, 65 per cent. soapstone, and 10 per cent. diatomaceous earth. This control was approximately as good as that given by an equal number of applications of Bordeaux mixture (6–2–100), which reduced infection to 3·2 per cent.

Miller (P. W.). **A report of progress and studies of the causes of the decline and death of Walnuts in Oregon.**—*Rep. Ore. St. hort. Soc., 1941*, pp. 124–126, 1 fig., 1942.

Investigations to date on the causes of the decline shown in recent years by many walnut orchards in Oregon indicate that the widely distributed mushroom root rot due to *Armillaria mellea* is of comparatively small importance, only 25 cases having been found in 10 years. Other possible parasitic agencies of decline (studies on which are in progress) include *Rhizoctonia* sp., *Verticillium* sp., *Fusarium* sp., *Ramularia* sp., *Pachybasium* sp., *Cadophora* sp., *Gloeosporium* sp., and *Chaetomium* sp., which have been isolated from dead roots and diseased crowns, but which, in limited tests, have not so far been found pathogenic.

Among the more important non-parasitic factors apparently operative are 'black line' or 'girdle' [*R.A.M.*, xix, p. 309], winter injury, shallow soil, drought, inadequate drainage, close planting, and combinations of these factors. Black line is a widely distributed disorder of Franquette walnuts grafted on Californian black walnut rootstocks or hybrids of other species with this one. Some 75 per cent. of the dead and dying trees found in grafted Franquette orchards show this trouble. Losses from winter injury have been negligible in the last five years. Most of the declining orchards are situated on shallow soils, in upland areas liable to drought. Poor drainage is a factor of considerable importance in Oregon, decreasing the vigour of the trees and rendering them subject to damage from winter injury, shot-hole borers, and other agencies; walnuts will not thrive on water-soaked soils or those with a high water table. Close planting chiefly affects the older orchards, where the trees as a rule are not more than 45 ft. apart.

Findlay (W. P. K.). **The prevention of decay in Beech.**—*Wood, Lond.*, vii, 2, pp. 37–38, 2 figs., 1942.

In order to prevent the development in felled beech logs of fungal decay, mainly caused by *Stereum purpureum*, which may penetrate from 4 to 5 ft. from the ends during the spring and summer, representing a loss of upwards of 20 per cent. of the timber, the writer advocates the regulation of the rate of felling in such a way as not to leave the wood lying for more than a very few weeks in the summer months. Where special conditions preclude immediate attention to the felled logs, the prompt application to the butt and top ends of a waterproof coating, such as hardened gloss oil or melanoid, will reduce the drying rate and thereby largely counteract splitting and the subsequent ingress through the cracks of 'dote'-producing organisms. Creosote may be substituted for the waterproof coating in the case of less valuable timber.

Cartwright (K. St. G.). **The variability in resistance to decay of the heartwood of home grown Western Red Cedar (Thuja plicata D. Don.) and its relation to position in the log.**—*Forestry*, xv, pp. 65–75, 2 figs., 2 graphs, 1941.

To determine whether the degree of resistance to fungal attack of the wood of *Thuja plicata* grown in England varies at different heights of the trunk and whether this variation is associated with concentration of water-soluble extractive, a tree

80 ft. tall and about 65 years old was cut down, and test samples were cut from the 30 ft. clear bole every 5 ft. along its length, representing the timber from varying points on the diameter, excluding the pith, at these heights. The samples were then inoculated with *Polystictus versicolor* and *Poria incrassata*, using a modified form of the wood-block method in which the fungi were cultivated on sawdust with an added accelerator. The samples were exposed to infection for a period of six months.

The results demonstrated that the resistance of English-grown western red cedar to white and brown rot is of the same order as that of imported timber. The heartwood from the base showed little variation across the trunk in point of resistance, the wood in this part being very resistant. There was, however, some evidence that the outer wood was more resistant to *Polystictus versicolor* than that next to the pith. The difference in resistance to both rots between the outer and inner heartwood of each section became increasingly apparent with increasing height, the newest heartwood being the most resistant. In each case, resistance declined as the centre of the tree was approached. The total average resistance across the trunk was greatest at the base, and progressively decreased up the tree.

The amount of material soluble in hot water was determined in samples from different positions in the trunk, and the toxicity of these extracts to *Fomes annosus* was determined. In each cross-section examined, the amount of material extracted by hot water was greater in the outer heartwood adjoining the sapwood than in the central heartwood, the toxicity of the extracts being correspondingly higher. Resistance therefore appeared to be closely correlated with amount of extractable substances present in the samples. Serious decay was found only in wood containing under 5 per cent. by weight of hot water extractives. Samples of Canadian-grown material analysed for extractives contained about 6·9 per cent., a figure exceeded by samples from the outer heartwood near the base of the English tree. The $P_H$ values of the Canadian and home-grown material were 2·2 and about 4·5, respectively.

It would appear that, in general, wood from butt planks of heartwood will be most resistant to infection, whether taken from the outer part or near the centre, but higher up, planks from the outer heartwood will be more resistant than those from the centre.

Widder (F.). **Untersuchungen über forstschädliche Cronartium-Arten.** [Studies on silviculturally injurious species of *Cronartium*.]—*Öst. bot. Z.*, cx, 2, pp. 107–117, 1941. [Abs. in *Biol. Abstr.*, xvi, 2, p. 460, 1942.]

The author's critical studies on the nomenclature of *Cronartium asclepiadeum*, *C. gentianeum*, and *Peridermium pini* [on pine: *R.A.M.*, xviii, p. 644] lead him to the acceptance of these names, while *P. truncicola* is retained as a collective name for the aecidia of all three species. The geographical distribution of *C. gentianeum* is outlined.

Neilson-Jones (W.). **Fused needle disease of Pines.**—*Emp. For. J.*, xx, 2, pp. 151–161, 2 pl., 1941.

After noting the occurrence of needle fusion [*R.A.M.*, xx, p. 340] on Corsican pine [*Pinus nigra* var. *poiretiana*], mountain pine [*P. mugo*] and Scots pine [*P. sylvestris*] (none of which is listed as susceptible by Young [cf. ibid., xix, p. 682]) in the vicinity of Wareham, Dorset, during 1941, and recording it as affecting *P. contorta* in Wales, *P. mugo* in Yorkshire, and *P. halepensis* in Arizona, the author describes and discusses experimental data obtained by him on this disease. Observations on trees in pot culture showed that severely affected *P. contorta* plants if potted in Wareham soil retained their characters for some years, but gradually recovered as the soil improved; recovery was invariably associated with the development of short roots and mycorrhiza. When such plants were potted in good woodland soil (e.g., from the New Forest) or in Wareham soil plus compost, they recovered the following year. Recovery was

similarly rapid when plants potted in Wareham soil received drainage water which had percolated through good woodland soil. Such treatment, like the addition of compost, removed the inhibitory effect of Wareham soil on fungal growth and permitted mycorrhizal development. The addition of 10 per cent. cellulose to Wareham soil in pot tests slightly depressed shoot growth and needle length, and reduced the growth of plants in New Forest soil to the level of plants grown in Wareham soil. Root examination showed that the addition of cellulose profoundly disturbed the formation of the normal mycorrhiza freely produced in New Forest soil, while in Wareham soil mycorrhizal production, in the absence of ameliorative treatments, is always poor. The needles of experimental plants grown in Wareham soil with or without cellulose were short, while those of plants in New Forest soil plus cellulose were much shorter than those of plants in New Forest soil alone, but less reduced than in plants in Wareham soil. In most of the plants in New Forest soil plus cellulose some needles developed hooks, suggesting incipient needle fusion.

In conjunction with the results of root examination, these data suggest that recovery from needle fusion occurs as soon as conditions are provided that favour short root production and the establishment of a normal mycorrhizal system. They also indicate that the incidence of the disease is associated with the arrest of short root development and of mycorrhiza formation, rather than with consistent mycorrhiza poverty.

Grafting experiments between healthy and affected trees gave negative results, entirely supporting Young's conclusion that the condition is not attributable to a virus. When small blocks of *P. contorta* in a stand with a high incidence of needle fusion were treated with solutions of zinc and boron by spraying the trees and dressing the ground, no effect whatever had become perceptible after three years. Experimental work by Dr. Rayner [cf. ibid., xix, p. 36] strongly supported Young's view that a correlation exists between the development of needle fusion and the phosphorus content of the substrate. In this connexion, it is pointed out that all the extensive plantings of *P. contorta* in which widespread needle fusion developed, and those of Corsican and mountain pine in which sporadic cases occurred, received no soil treatment but ploughing, the effect of which is to dilute the small amount of phosphorus present in the top few inches.

The author does not accept Young's carbohydrate hypothesis [ibid., xix, p. 683], but ascribes the development of needle fusion to a sudden shortage of water in the plant as the leaves start to expand, the deficiency arising from reduced root absorption owing to failure of the root system to provide functional short roots and mycorrhiza at this critical juncture.

Thomas (W. D.). **A survey of northern Colorado flora bearing mycorrhizae.**—*J. Colo.-Wyo. Acad. Sci.*, iii, 1, pp. 37–38, 1941. [Abs. in *For. Abstr.*, iii, 4, p. 283, 1942.]

Common species of Salicaceae, Fagaceae, Ulmaceae, and Betulaceae in northern Colorado bear only ectotrophic mycorrhiza; some of the Oleaceae are associated exclusively with ectendotrophic mycorrhiza; while members of the Pinaceae and Rosaceae harbour both forms. A list is given of 21 families, in some of which the mycorrhizal relationships are endotrophic.

Bailey (H. E.). **The biology of Polyporus basilaris.**—*Bull. Torrey bot. Cl.*, lxviii, 2, pp. 112–120, 4 figs., 1941.

For many years past, *Cupressus macrocarpa*, extensively planted in California as an ornamental, has been affected by a brown pocket rot caused by *Polyporus basilaris* n. sp. A field study showed that only 2 per cent. of the trees examined had become infected by the age of 26 years, while in another stand 88 per cent. were infected at an average age of 65 years. Rotting was confined to the bole, though very occasionally present in the branches and roots. In the early stages, the trunk frequently shows

only a single pencil of rot, extending for a distance of from a few inches to 2 ft.; the infected wood appears almost normal, but is usually tinged with yellow. When the infected pockets dry out, they darken and show fine checks. In severely decayed trees, one or more pencils of rot may occur on the advancing line of decay, which spreads by long finger-like protrusions into the heartwood. The rot gradually becomes very complete, and leaves a brown, crumbly residue, which cracks into squares or rectangular blocks. In advanced stages, the pockets coalesce, forming masses of rot with thin, irregular strips of firm wood scattered through the mass. White mycelial wefts often appear in the cracks, but there is no apparent discoloration in the wood beyond the sharp border of the pockets. Active mycelium was found only in a narrow margin round the pocket of rot.

The sporophores are described as annual or reviving with only marginal growth, frequently poorly developed and nodulose in furrows on the trunk, imbricate where well-developed, tough and leathery when fresh, rigid and hard on drying. The applanate or somewhat convex, dirty greyish pileus measures 1 to 4 by 2·5 to 6 by 0·4 to 0·8 cm., and becomes greyish-brown or blackish on drying; the pore surface is white when fresh, unchanged in drying, or becoming isabelline or dirty buff, the tubes 1 to 3 mm. long, the mouths circular, then subangular to irregular, thick-walled, entire, averaging 3 to 4 per mm. The ellipsoid or narrow-ellipsoid, smooth, hyaline spores measure 4 to 5 by 2·5 to 3·5 $\mu$. No cystidia were observed.

In culture, mycelial growth was slow. Only a thin, thread-like reticulum of interwoven hyphae covered the surface of the wood block (*C. macrocarpa*) in a sparse, white growth, but analyses on wood samples from blocks which had lost 10·2, 18·1, and 39 per cent. weight during decay showed that the fungus had progressively utilized many of the components of the wood.

Hirt (R. R.) & Hopp (H.). **Relation of tube layers to age in sporophores of Fomes igniarius on Aspen.**—*Phytopathology*, xxxii, 2, pp. 176–178, 1 fig., 1942.

The results of a five years' study on 20 sporophores of *Fomes igniarius* of known age from aspen at the Charles Lathrop Pack Demonstration Forest, Warrensburg, New York, indicated that one tube layer is normally formed in the hymenophore each year, departures from this rule being associated with restrictions of growth by surrounding callus or other adverse factors.

Rennerfelt (E.). **Chemical treatment of wet mechanical pulp in order to control damages caused by fungi.**—*Svenska SkogsvFören. Tidskr.*, xxxix, 1, pp. 19–94, 13 figs., 4 graphs, 1941. [Swedish summary.]

Most of the information presented in this comprehensive survey of the writer's laboratory experiments and practical observations on the control of the fungi responsible for the blue staining (e.g., *Pullularia pullulans*) and rotting (e.g., *Polystictus versicolor*) of wood pulp in Swedish factories has already been noticed from other sources [*R.A.M.*, xxi, p. 58], but the following points may be noted. None of the other preparations tested equalled lignasan and pulpasan (ethyl mercury chloride) in antiseptic value, the amounts of santobrite, dowicide, and tebecit (sodium orthophenylphenolate) required for the elimination of *Pullularia pullulans*, for instance, being 10, 40, and 100 times, respectively, as much as the appropriate dosage with pulpasan, i.e., 200 gm. per ton, the cost of which is estimated at Kr. 0·33 (at par). *Polystictus versicolor* is much more resistant to treatment than *Pullularia pullulans*, necessitating the application of 2·5 to 5 kg. of the fungicide per ton. Subjective measurements of whiteness (a criterion of freedom from fungal damage) are apt to give inconsistent results in cases of superficial infection, and should be repeated on suspended or refiltered samples.

Rennerfelt (E.). **Die Empfindlichkeit einiger Phoma-Arten gegen Quecksilberverbindungen.** [The sensitivity of some *Phoma* species to mercury compounds.]—*Zbl. Bakt.*, Abt. 2, civ, 2–3, pp. 71–77, 1941.

At the Gothenburg (Sweden) Botanical Institute, the writer conducted experiments to determine the possibility of combating four organisms causing blue stain of wood pulp, viz., *Phoma conidiogena* [*R.A.M.*, xiii, p. 738], *P. lignicola* (strains a and b), and an unidentified species, *Phoma* A, by means of three mercury compounds, viz., mercuric chloride, pulpasan [see preceding abstract], consisting of 6 per cent. ethyl mercury chloride, soda, and sodium sulphate, and ethyl mercury chloride alone. The fungi were grown on malt agar and in saccharose-containing nutrient solutions with the admixture of various concentrations of the disinfectants. The two organic preparations were found to exert a much stronger fungicidal action than the inorganic, pulpasan being 5 to 20 and ethyl mercury chloride 80 to 320 times as effective as mercuric chloride; the requisite amounts of the three materials for the inhibition of germination of 1,000,000 spores of *P. conidiogena*, for instance, were 0·32, 0·02, and 1·6 mg. per flask, respectively, while *Phoma* A succumbed to only 0·005 mg. ethyl mercury chloride. *P. lignicola* was much more resistant to the action of mercury than the other species, 5 to 10 times the quantity of antiseptic being necessary for its elimination (up to 100 times in one test with mercuric chloride). These differences are probably attributable to variations in the internal structure of the conidial protoplasm, but the data at hand are insufficient to afford a convincing explanation of the phenomenon.

Hardy (E.). **Dry rot in the textile industry.**—*Text. Rec.*, lix, 709, p. 38, 1942.

Dry rot (*Merulius lacrymans* and other fungi) is stated to be exceptionally prevalent in the woodwork of textile factories, where the normal methods of controlling the fungus by a reduction in atmospheric humidity and temperature are not ordinarily practicable. Prevention must therefore be based primarily on the use of resistant woods, e.g., Rhodesian, Burma, Nigerian, or Borneo teak, tallow wood (*Eucalyptus microcorys*), deodar, juniper, Californian redwood [*Sequoia sempervirens*], southern cypress [*Taxodium distichum*], yew, larch, Australian jarrah [*E. marginata*], western red cedar [*Thuja plicata*], Port Orford cedar [*Chamaecyparis lawsoniana*], or yellow cedar [*Cupressus nootkatensis*]; and preservation with a reliable chemical antiseptic, such as solutions of arsenical salts, two coats of hot creosote (140° F.), 2 per cent. Wolman salts (triolith), 2 per cent. sodium fluoride, copper sulphate, or zinc chloride. Changes in the affected wood include loss of weight (which may reach 70 or 80 per cent.), deterioration in toughness, a damp, musty smell, increasing acidity, and liability to burning and insect attack.

White lead plus zinc chrome (2 per cent.) is the best paint for use in textile factories where moulds are prevalent. Zinc oxide is also a good preservative, and before repainting an antiseptic treatment with 1 in 100 sodium pentachlorphenate is recommended. Black fungal spotting on paint-work may be removed with soapy water containing carbolic acid and formalin, followed by 1 per cent. mercuric chloride.

Wilson (H. B.) & Gregory (J. N.). **A quantitative investigation of the steeping method for the preservation of timber. A modern application of an old process to Australian mine timbers.**—*J. Coun. sci. industr. Res. Aust.*, xiv, 4, pp. 281–287, 1941.

In an investigation carried out in Australia to find a suitable method for preserving round green mine timbers, pieces of freshly felled *Eucalyptus obliqua* carrying a piece of sapwood, about 6 in. square by 1 in. thick, were lacquered on all faces except the bark (which was removed only immediately before treatment) and subjected to one of the following treatments: one month, two weeks, or one week in either 5, 10, or 20 per cent. solutions of zinc chloride (fused) or copper sulphate crystals, the concentrations

being based on the weight of the anhydrous salts. After treatment, each sample was removed and allowed to dry in the air, after which the timber was analysed for the presence of the salts. From a practical point of view, the amount of chemical absorbed and the penetration obtained were very satisfactory. In the specimens treated in 5 per cent. solutions for one week, the concentrations of dry chemical half an inch from the surface were approximately 0·4 per cent. This is equivalent to 0·1 to 0·2 lb. of dry salt per cubic foot of treated wood. Concentration increased rapidly towards the outer surface.

It is concluded that treatment of the sapwood of *E. obliqua* by immersion in cold aqueous solutions of zinc chloride or copper sulphate gives penetrations and absorptions of the order required for preserving the wood under service conditions in mines. A very high concentration, amounting probably to several lbs. of chemical per cu. ft. of treated wood, is quickly built up in the outer layers of the sapwood (up to $\frac{1}{8}$ in. in depth). For timbers intended for a short service life (5 years) an immersion for one week in a cold 5 per cent. solution of zinc chloride or copper sulphate would probably suffice. If longer service life is required, longer immersion periods and more concentrated solutions can be used. Treatment must be effected when the timber is freshly cut, before surface drying has occurred.

Green (D. E.). **Hygiene in the war-time vegetable garden. XI. XII. XIII. XIV.**—*J. R. hort. Soc.*, lxvii, 1, pp. 33–39, 2 pl. (between pp. ii and iii); 2, pp. 62–68, 2 pl. (between pp. xii and xiii); 3, pp. 97–102, 2 pl. (between pp. 90 and 91); 4, pp. 136 and 142, 2 pl. (between pp. xxvi and xxvii), 1942.

These further instalments of the author's series of instructions on the care of British war-time allotments [*R.A.M.*, xxi, p. 112] comprise observations on the diseases of beets, maize (sweet corn), seakale, Jerusalem artichokes [*Helianthus tuberosus*], asparagus, rhubarb, horse-radish, mushrooms, mint and other herbs, cress, and watercress.

Ramsey (G. B.) & Wiant (J. S.). **Market diseases of fruits and vegetables: Asparagus, Onions, Beans, Peas, Carrots, Celery, and related vegetables.**—*Misc. Publ. U.S. Dep. Agric.* 440, 70 pp., 16 pl. (8 col.), 1941.

This publication is the seventh in a series designed to assist in the recognition and identification of pathological conditions of economic importance affecting fruits and vegetables in storage and transit and on the market, to facilitate the inspection of these products when exposed for sale, and to prevent the losses arising from such causes. It is an amplified and revised version, including some excellent new coloured illustrations, of the 'Handbook of diseases of vegetables occurring under market, storage, and transit conditions', prepared by G. K. K. Link and M. W. Gardner and published by the United States Department of Agriculture in 1919. Reference to most of the diseases described under the various crops has been made from time to time in this *Review*. An 11-page bibliography is appended.

Coke (J. E.). **Disease and bolting resistance in varieties.**—*Sug. Beet Bull.*, vi, 1, p. 5, 1942.

In a series of varietal tests on sugar beets conducted by the Spreckels Sugar Company in California from 1939 to 1941, the incidence of curly top in the newly developed strains, U.S. 15, U.S. 33, U.S. 22, and U.S. 23 [*R.A.M.*, xxi, p. 114] was as follows: December, 1939 (two first-named only) 7 and 2 per cent., respectively; March 1940 (two locations), 55, 26, 12, and 12, and 97, 50, 13, and 15 per cent., respectively; and February, 1941, 6·11, 1·67, 0, and 0·33 per cent., respectively, the figures for the Old Type on the corresponding dates being 8, 59, 89, and 4·44 per cent., respectively. It is apparent from these data that U.S. 22 excels all the other strains in commercial use from the standpoint of curly top resistance, closely followed by 23, while 33 withstands the disease adequately, at any rate in the mild and localized form

in which it has occurred of recent years. U.S. 22 and 23 are particularly well adapted for late, and 33 and 12 (intermediate between 22 and 33 for resistance to curly top) for mid-season planting. None of the new strains equalled U.S. 15 and Old Type in respect of resistance to mildew [*Peronospora schachtii*: ibid., xix, p. 131].

WALKER (J. C.). **Physiologic races of Plasmodiophora brassicae.**—Abs. in *Phytopathology*, xxxii, 1, p. 18, 1942.

Several turnip and swede varieties, tested with various collections of *Plasmodiophora brassicae* from widely separated localities in the United States, remained completely free from club root in heavily infested soil. One of these, Purple Top Milan turnip, grown in naturally infested soil in two districts in England (by F. T. Bennett in the north and by N. C. Preston in Shropshire), developed some 20 per cent. infection in each case. On the other hand, an English variety, White Stone, which produced 87 per cent. diseased plants in a trial in England, developed no clubbed roots on inoculation with a representative American isolate. These data are regarded as establishing the existence of physiologic specialization in *P. brassicae* [*R.A.M.*, xii, p. 608].

DENNIS (A. C.). **Boron deficiency in members of the Cabbage family.**—*Fertil. Feed. St. J.*, xxvii, 4, pp. 41, 43; 6, pp. 55, 57, 3 figs., 1942.

The available information concerning boron deficiency in crucifers [*R.A.M.*, xxi, pp. 60, 113] is summarized and the symptoms of the trouble described in relation to particular crops. Directions are also given for the control of the disorders due to lack of boron by the introduction of the element into the soil in the form of borax or boric acid, preferably in amounts not exceeding 20 lb. per acre for the former and 13 lb. for the latter.

BRENCHLEY (W[INIFRED] E.) & WARINGTON (K.). **Value of molybdenum for Lettuce.**—*Nature, Lond.*, cxlix, 3772, p. 196, 1942.

In work on the minor element constituents of Chilean nitrate it was found that one part of molybdenum [cf. *R.A.M.*, xx, pp. 56, 479] (as sodium molybdate) in 10,000,000 of nutrient solution improved the size, colour, and disease resistance of lettuces. This improvement occurred whether the molybdenum was used alone or in conjunction with one or more other minor elements. Preliminary tests gave some indication that molybdenum can retard the appearance of boron deficiency symptoms in the early stages of growth.

JENKINS (J. M.). **Downy mildew resistance in Cucumbers.**—*J. Hered.*, xxxiii, 2, pp. 35–38, 2 figs., 1942.

Out of over 80 varieties and strains of cucumber tested in 1939 at the South Carolina Agricultural Experiment Station for their reaction to downy mildew (*Peronospora* [*Pseudoperonospora*] *cubensis*), only China and Puerto Rico No. 37 [*R.A.M.*, xx, p. 564] gave evidence of a high degree of resistance, with indices of 3 and 1, respectively (classified on a scale from 0, representing immunity, to 10, denoting complete susceptibility). Neither of these varieties, however, satisfied market requirements, and each was accordingly crossed with Colorado, a good commercial variety, in order to combine the desirable characteristics of the latter with the resistance to mildew of No. 37 and China. The $F_1$ plants were intermediate both as regards resistance and the size and shape of the fruits. In the $F_2$, 17 plants were equally resistant with the resistant parent, 26 as susceptible as Colorado, and 545 intermediate—the last-named group, however, comprising individuals only slightly less susceptible than the commercial parent and others almost equalling the resistant progenitor in resistance. Genetic studies on the inheritance of resistance to *P. cubensis* are being continued in the $F_3$.

In a comparative test in 1941 on the A. & C., Colorado, China, and No. 37 varieties, the last-named was again the least affected by the pathogen.

DEMAREE (J. B.) & RUNNER (G. A.). **Control of Grape diseases and insects in eastern United States.**—*Fmrs' Bull. U.S. Dep. Agric.* 1893, 28 pp., 21 figs., 1942.

Brief, practical notes are given on the symptoms, causes, and control of the principal vine diseases found in regions of the United States east of the Rocky Mountains. Those mainly attacking American bunch grape varieties include black rot (*Guignardia bidwellii*), downy mildew (*Plasmopara viticola*), anthracnose (*Elsinoe ampelina*), ripe rot (*Glomerella cingulata*), bitter rot (*Melanconium fuligineum*) [*R.A.M.*, xvii, p. 726], dead arm (*Cryptosporella viticola*) [ibid., xvii, p. 499], powdery mildew (*Uncinula necator*), and root diseases due to crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) [cf. ibid., xvii, p. 727] and the cotton root rot fungus (*Phymatotrichum omnivorum*) [ibid., x, p. 241]. The diseases of muscadine grapes [cf. ibid., xx, p. 623; xxi, p. 239] dealt with include black rot (which does not cause decay of the fruits, but produces fruit scab and foliar spotting), bitter rot, and two fungi which attack old foliage, viz., a species of *Cercospora* [loc. cit.] and *Isariopsis clavispora* [ibid., xvii, p. 843].

The authors point out that downy mildew, being favoured by cool, moist weather, is of minor importance in the southern regions of the United States. The disease is comparatively easy to control, and seldom produces damage in vineyards sprayed regularly against black rot.

The general spray programme recommended (though modifications are, naturally, required to adapt it to the requirements of different localities) is as follows: (1) spray with Bordeaux mixture (4–4–50) when the new shoots are 7 to 8 in. long; (2) the same plus 1 lb. calcium arsenate or lead arsenate and $\frac{1}{2}$ pint fish oil or linseed oil per 50 gals. spray one week before blooming; (3) repeat (2) just after the blossoms fall; (4) two weeks after (3) spray with Bordeaux mixture (4–4–50) plus $\frac{3}{8}$ pint of nicotine sulphate (40 per cent. nicotine) and 1 lb. resin-fish oil soap (or $\frac{1}{2}$ pint fish oil or linseed oil) in 50 gals. of spray; and (5) two or three weeks later, or when the fruit is about half-grown make a final application of Bordeaux mixture (4–4–50). In regions where black rot is serious preliminary application of Bordeaux mixture (4–4–50) must be given when the shoots are only 1 to 2 in. long. Emphasis is laid on the fact that the early sprays are the most important ones.

Because of the long growing season and frequent rains in Florida and other South Atlantic and Gulf States, the spray schedule which suffices to control vine diseases in the area north of the Ohio River and east to the Atlantic coast is inadequate in the former region, where twice as many sprays may be required as in Michigan; growers residing south of Virginia, Tennessee, and Missouri should seek official advice on the timing and number of applications.

NICHOLSON (A. J.), DICKSON (B. T.), HYNES (H. J.), & EVANS (J. W.). **Plant quarantine. Report of the Central Committee appointed by the Australian Institute of Agricultural Science to deal with Overseas Plant Quarantine.**—*J. Aust. Inst. agric. Sci.*, vii, 4, pp. 143–146, 1941.

This report of the central committee appointed by the Australian Institute of Agricultural Science to examine the Australian system of overseas plant quarantine states that the members agreed in the first place that plant quarantines must be based on sound biological principles and that the objectives aimed at must be such that there is a reasonable possibility, from a biological standpoint, of attaining them. They must be economically justifiable, not unnecessarily restrictive, and never used for any purpose but the exclusion of pests and diseases, while their administration must remain independent of outside interests. The requirements of an efficient plant quarantine service are: a well-trained staff, appropriate regulations, and satisfactory equipment and facilities.

Recommendations are made on these aspects. There should be three specialist assistants with the Director of Plant Quarantine, acting as a central staff, which should study plant diseases and pests, and collate the information obtainable as to their economic importance, life-history, host range, world distribution, and the likelihood of their introduction into Australia. The Central Quarantine Office should act as an information bureau, to which all information concerning the introduction and subsequent spread or disappearance of all introduced pests, diseases, and weeds should be sent. This information would then be passed on to all the States concerned, and would be followed periodically by progress reports. A full-time, well-trained Commonwealth Quarantine Officer should be employed in each State. The part-time employment of State officers in Commonwealth inspection duties should be continued. The appointment of an Advisory Plant Quarantine Board, such as exists in Canada and South Africa, is not recommended, but an advisory committee in each State would serve a useful purpose. It is also desirable that a National Advisory Committee, comprising one representative from each State committee, should be formed to assist the Director of Plant Quarantine on occasion.

Recommendations for suitable regulations indicate types of regulation covering all contingencies. Equipment is too costly to be provided at all ports of entry. Hence, plants and plant products in certain categories should be allowed entry only at ports where special facilities are available. An inspector should be stationed at each port of entry of overseas goods.

The present position is that there is a Director of Plant Quarantine appointed by the Commonwealth Government in 1927, who is responsible to the Permanent Head of the Department of Health. No other full-time officer has been appointed to the Commonwealth service for plant quarantine. All other officers are appointed at the request and on the recommendation of the State Departments of Agriculture, and from the services of these Departments, being State officers seconded for Commonwealth service. Some 75 quarantine officers are at present engaged in inspection duties for the Commonwealth; of these, seven are wholly occupied in foreign plant quarantine work.

The report concludes by pointing out that in comparison with the sums spent on the attempted control of diseases, weeds, and pests, already introduced, the amount at present devoted to the exclusion of others is nugatory. The further sums required to ensure the efficiency of the plant quarantine service should be looked upon as an insurance, as the increased expenditure would, actually, represent a real economy in the national interest.

Ferraz do Amaral (J.). **Videiras de facil cultura.** [Easily cultivable Vines.]—*Biológico*, viii, 1, pp. 15–19, 2 figs., 1942.

The Seibel No. 2 hybrid, locally known as Corbina, is stated to be virtually the only vine grown on a commercial scale in São Paulo, where it gives satisfactory yields and is sufficiently resistant to anthracnose [*Elsinoe ampelina*: *R.A.M.*, xix, p. 366] and *Peronospora* [*Plasmopara viticola*] provided the normal cultural methods are supplemented by three summer applications of Bordeaux mixture and one winter treatment with lime-sulphur. Of the various other Seibel hybrids grown experimentally, only No. 6,905 proved extremely susceptible to *E. ampelina*, to which, as well as to *P. viticola*, Nos. 7,053, 10,096, 8,712, 6,486, 4,986, and 5,213 were equally resistant with No. 2.

Donen (I.). **Mould control in Grapes. Results obtained with the use of sulphur dioxide.**—*Fmg S. Afr.*, xvii, 192, pp. 199–208, 3 graphs, 1942.

In experiments carried out in Cape Town on the control of mould [unspecified] in table grapes [*R.A.M.*, xx, p. 50], Waltham and Barlinka grapes were treated by exposure before packing to 2 per cent. sulphur dioxide gas for 30 minutes at 68° F.,

by similar exposure after packing, by placing a 0·25 gm. tablet of sodium acid sulphite with each bunch, and by both gassing and tablet treatment before packing. Gassing was effected in the packhouse, where the fruit was left for seven days, after which it was examined. In the Barlinka grapes, the untreated controls showed 169 mouldy berries per five boxes, with 44 per cent. green stalk, while the corresponding figures for the different treatments were, gas before packing 72 and 96 per cent., tablets 49 and 55 per cent., gas and tablets 0 and 100 per cent., and gas after packing 8 and 90 per cent. In the Waltham Cross grapes, the corresponding figures were 126 and 0 per cent., 56 and 70 per cent., 60 and 36 per cent., 23 and 87 per cent., and 22 and 80 per cent. The best results were found in the fruit gassed after packing. Gas treatment conspicuously affected the appearance of the stems, which remained fresh and yellow-green, in contrast to the controls, which were brown and dry. Fruit given gas and tablets showed some bleaching of the stalk and slight discoloration of a few berries.

In a further test, two lots of Barlinka grapes were exposed to 2 per cent. sulphur dioxide for 35 minutes after packing. After seven days, the first lot showed 25 mouldy berries and 82 per cent. green stalk, and the second lot 116 mouldy berries and 66 per cent. green stalk, as against 227 mouldy berries and 19 per cent. green stalk in one control lot and 252 mouldy berries and 61 per cent. green stalk in the other control. The gas treatment is considered to have lengthened the commercial life of the fruit by eight days. Apparently, the sulphur dioxide only served to retard the onset of mould attack, since the graphs for the amount of mould in the treated grapes and controls met after 19 days. Even after 21 days' storage at 32° the beneficial effect of the gas was noticeable.

On several occasions gas-treated grapes fetched higher prices than untreated controls in commercial markets. The treatment caused no injury of any commercial importance.

It is considered that this gas treatment offers a very promising method of increasing the selling life of non-refrigerated grapes sent to African markets. The method is very suitable for mass treatment in which concentration and time can be controlled, and can be applied to fruit in any container. The cost of gas and extra handling should be under one halfpenny per box of fruit. The cost of constructing a special chamber for the treatment measuring 3 ft. 6 in. by 3 ft. 4 in. by 6 ft. amounts to about £10 locally, and there is also the fan to be purchased. This outlay, however, when reckoned over a period of years, is negligible.

**Legislative and administrative measures.**—*Int. Bull. Pl. Prot.*, xv, 11, pp. 206M–207M, 1941.

Germany (Protectorate of Bohemia and Moravia). Notification No. 463 of 24th February, 1941, promulgated by the Minister of Agriculture, defines the localities to be regarded as 'prohibited zones' owing to the actual or suspected presence of potato wart disease (*Synchytrium endobioticum*) [*R.A.M.*, xix, p. 320] therein or in the immediate vicinity. The export of potatoes or potato trash from prohibited to non-prohibited areas, and the introduction into, and cultivation within, the prohibited zones of wart-susceptible varieties are interdicted.

Decree No. 227 of 6th March, 1941, amending No. 133 of 22nd February, 1940, provides for the disinfection with a formaldehyde solution of railway trucks which have been used for the transport of potatoes cultivated in a prohibited zone.

As from 1st March, 1945, the cultivation of potatoes other than those resistant to *S. endobioticum* will be disallowed.

Germany (Saxony). The Decree of 22nd May, 1940, relative to the control of asparagus rust (*Puccinia asparagi*) [cf. ibid., xv, p. 192], was suspended for the duration of the year 1941 owing to war conditions.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW

OF

# APPLIED MYCOLOGY

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[WATERSTON (J. M.).] **Plant pathology.**—*Rep. Dep. Agric. Bermuda, 1941*, pp. 8–9, 1942.

The most destructive disease investigated during the period under review [cf. *R.A.M.*, xx, p. 392] was potato blight (*Phytophthora* [*infestans*]), which caused heavy losses during the last few days of the year. Leaf roll was prevalent in Bliss Triumph potatoes grown from Long Island seed, up to 40 per cent. infection being recorded compared with only 5 per cent. for Nova Scotian material. Black rot of broccoli (*Xanthomonas campestris*) and tomato fruit spot (*X. vesicatoria*) were encouraged by the wet weather in December. A Discomycete that developed on loquat fruits in the laboratory was identified by H. H. Whetzel as a new species of *Lambertella*, which has also been collected on *Jasminum simplicifolium* berries, while a fungus found on fiddlewood (*Citharexylum spinosum*) may prove to be the same. *Botryosphaeria ribis* (also in its imperfect *Dothiorella* stage) occurred in a weakly parasitic form on cassava, the first report of the organism on this host in Bermuda. Another new record for the island was *Puccinia secalina* on a small experimental planting of rye, an obvious case of seed transmission. New hosts for *Sclerotinia sclerotiorum* included swedes and *Anemone coronaria*, while *Botrytis cinerea* was observed for the first time causing chocolate spot of broad bean.

NANCE (NELLIE W.). **Diseases of plants in the United States in 1939.**—*Plant Dis. Reptr, Suppl.* 128, 378 pp., 12 graphs, 9 maps, 1941. [Mimeographed.]

This, the 23rd annual report compiled by the Plant Disease Survey of the United States Department of Agriculture, is drawn up on the familiar lines of preceding reports [*R.A.M.*, xix, p. 692].

**Report of progress for year ending June 30, 1941.**—*Bull. Me agric. Exp. Sta.* 405, pp. 401–535, 3 figs., 3 graphs, 2 maps, 1941.

This report [cf. *R.A.M.*, xviii, p. 577] contains the following items of phytopathological interest. D. Folsom describes the effects of different spray and dust materials on scab [*Venturia inaequalis*], growth, and yield in two McIntosh apple orchards. In one, two rows of trees 27 years old were given the same treatment from 1920 to 1934, after which one received full-strength and the other half-strength lime-sulphur for four years. Both then received identical treatment for two years. When the strength of the lime-sulphur was reduced, the yield was increased at first, but in the second year the yield of scabby fruit was increased by nearly a bushel per tree.

In the second orchard, 335 trees set out in 1928 and treated as follows, viz., (*a*) dry lime-sulphur 1928 to 1940, (*b*) dry lime-sulphur 1936 to 1940, (*c*) mild sulphur (flotation, bentonite, applied as a spray) 1928 to 1940, and micronized 1940, and (*d*) bentonite sulphur dust (1928 to 1940, 1·10 lb. per tree in 1940) gave, respectively, in 1940, 93·8, 92·6, 96·9, and 79·6 per cent. clean fruit. The mild sulphur spray and

sulphur dust did not affect the amount of wood formed as represented by trunk girth while nearly doubling the yield owing to an increase in the number of fruits per tree.

R. M. Bailey and I. M. Burgess state that the Maine No. 2 cucumber is of high table quality and very resistant to *Cladosporium cucumerinum* [ibid., xx, p. 510].

Observations by R. Bonde and B. E. Plummer indicated that the Katahdin, Chippewa, and Sebago potato varieties are very susceptible to injury resulting from seed treatments against *Rhizoctonia* [*Corticium solani*]. In an experiment carried out in 1940 seed potatoes of the Sebago, Green Mountain, and Irish Cobbler varieties were treated in mercuric chloride solution (0·2 per cent.) plus acetic or hydrochloric acid (1 per cent. of either) for 5 and 10 minutes. All the varieties were injured and pitted by the treatments, damage being most severe on Sebago, in which 43 to 59 per cent. of the seed pieces failed to sprout.

R. Bonde states that potato ring rot [*Bacterium sepedonicum*: ibid., xxi, pp. 40, 94] remains a major problem in Maine. Between 1st January and the end of the 1940–1 season about 33 per cent. of the carload lots of potatoes examined at railway loading centres in Maine contained some ring rot. The only practical method of control is to eliminate all diseased seed stocks and plant only clean ones. Seed treatment for 5 minutes in a 1 in 500 acidulated mercurial dip containing 1 per cent. hydrochloric acid or 2 per cent. acetic acid gave excellent control against seed-piece contamination. For disinfecting storage bins, containers, and equipment, the coal tar disinfectants having a phenol coefficient of six appeared to be very effective, when used at a dilution of 1 qt. in 25 gals. of water. In varietal resistance tests some varieties showed no ring rot even two years after experimental inoculation.

Chemical studies by A. F. Ross on potato stem-end browning [ibid., xix, p. 492] showed that the necrotic areas of affected tubers contained 5 to 18·1 (average 11·2) p.p.m. of copper, as against 11·3 to 31·2 (average 20·1) p.p.m. of copper for corresponding parts of normal ones.

F. Upton and D. Folsom state that net necrosis [loc. cit.] was abundantly present in stored samples from two Green Mountain fields in which leaf roll had spread, while stem-end browning was common in stored samples from two Green Mountain fields where it had occurred before, provided the storage temperature was maintained at about 50° F. and that sufficient storage time had elapsed. There was less of either type of discoloration at 38°, 32°, and 60° than at 50°, and least of all at 32°. At the optimum temperature stem-end browning continued to increase until the middle of November, and net necrosis until some time in April. In November the warming-up of samples previously kept at inhibiting low temperatures induced net necrosis, but not stem-end browning. Relative humidity appeared to have no consistent effect on either condition.

D. Folsom isolated fungi and bacteria from stem-browning tubers from eight different sources. Of 80 tubers tested, 60 per cent. were sterile. Organisms isolated from the remainder were inoculated into the stem ends of recently dug Green Mountain tubers, which, however, developed less stem-browning than the controls.

G. W. Simpson, R. Bonde, W. F. Porter, and D. H. Perrin, describing the work of the foundation seed potato programme (started in 1939), state that 53 growers applied during the spring of 1940 for the roguing of about 237 acres of potatoes. Each plot was rogued a single row at a time at least once a week for six weeks. Seed was taken on all plots producing tubers with an average weight of 1 lb. per hill, the amount of seed required being obtained from plants whose tops were removed by pulling. Before the rest of a plot was dug a test sample was taken, grown in Florida and checked for disease content. Only stocks with not more than 1·5 per cent. total virus were accepted as of foundation standard. Observations in the Florida test plot made by G. W. Simpson, W. F. Porter, and D. H. Perrin showed that the samples ranged from 'no disease evident' to 68 per cent. total virus. The Chippewa variety had the highest disease content, with only 5 out of 28 samples qualifying, and Katahdin the lowest.

D'ANGREMOND (A.). **Verslag van den Directeur van het Algemeen Proefstation der A.V.R.O.S. over het tijdvak 1 Januari 1937–31 December 1939.** [Report of the Director of the General Experiment Station of the A.V.R.O.S. for the period from 1st January, 1937, to 31st December, 1939.]—*Meded. alg. Proefst. Avros*, Alg. Ser., 59, 76 pp., [? 1940. Received May, 1942.]

The following items of phytopathological interest occur in the botanical section of this report (pp. 25–38). The white root fungus (*Rigidoporus microporus*) [*Fomes lignosus*] is the principal pathogen of the underground system of *Hevea* rubber in Sumatra [*R.A.M.*, xix, p. 44]. The use for interplanting of leguminous shrubs, such as lamtoro [*Leucaena glauca*], *Crotalaria, Tephrosia candida,* and *T. vogelii,* should be discouraged in cleared land, since their wide-spreading roots offer an easy foothold to the fungus and facilitate its further dissemination. In one plantation where both *T. candida* and *Derris elliptica* were used for interplanting, *F. lignosus* was found on the roots of both, killing those of the former but apparently not affecting those of the latter host. In another estate the roots and stumps were left in the ground after clearing operations. The white root fungus had never been observed in the old stand, but $1\frac{1}{2}$ years after replanting, 20 per cent. of the trees were found to be infected.

Experiments in the preventive and curative treatment of root rot and patch canker (*Phytophthora*) of bud grafts, initiated in 1936, were concluded during the period under review. In the former series 100 trees of each of the clones AV 49, AV 152, and AV 163 were sprayed with various fungicides in March and April, 1936, and September, 1937, while 300 were left untreated as controls. Even in these the incidence of the disease was not high (7 per cent.), but within the limits thus imposed the best results were given by poliflor and lime-sulphur, of which the latter is to be preferred as three times cheaper than the former, two annual treatments costing Fl. 5 to 6 per ha. However, prophylactic measures against the form of *Phytophthora* under observation are only warranted where heavy infection is to be anticipated, since curative treatments can be given at a yearly cost of only about 60 cents per ha.

Suitable mixtures for the control of mouldy rot (*Ceratostomella fimbriata*) were found to consist of (*a*) 50 parts asphalt, 30 of petroleum, and 20 of Rütgers' non-emulsible carbolineum, and (*b*) 50 of special socony product 2295A, 30 of solar oil, and 20 of Rütgers' carbolineum; both socony product 2295A and petrolatum S642 B.P.M., which may be substituted for it if desired, are transparent vaseline preparations. However, the most effective of all mouldy rot disinfectants is a non-burning coal tar, and in this connexion mention is made of the necessity of testing each individual drum for the action of its contents on susceptible clones, e.g., AV 50 and 256.

*Botryodiplodia theobromae* was found in the dead tissues of bud grafts used as replacements; presumably the fungus entered the upper stem through the stump wound and occurred in a purely secondary capacity.

Stem rot (*F. noxius*) of oil palm [ibid., xvii, p. 301] was observed on one estate. *Poria ravenalae* [ibid., xvi, p. 656] is prevalent on dead leaf bases, but causes practically no damage to living palms. With the wide extension of oil palm cultivation during recent years the problem of crown disease [ibid., xv, p. 147] has again come to the fore. Since the cause of the trouble is unknown, no actual control measures can be suggested, but the following steps are recommended in plantings: (1) every six months (from the date of the first appearance of the disease) the leaf bases of affected palms should be marked with paint and all those with three marks (i.e., after a year's sickness) removed and replaced by healthy specimens; (2) direct substitution of sound for diseased palms. The former method is indicated where the number of available replacements is small or that of diseased palms large, while the latter may be adopted where the opposite conditions obtain.

Tea and the interplanted *L. glauca* on heavy forest soil were infected by *Rosellinia arcuata*, *R. bunodes*, and *F. noxius*, the first-named also attacking *T. candida* and *T. vogelii*. Grey blight (*Pestalozzia theae*) occurred in nursery beds and elsewhere, while one case only of *B. theobromae* on tea was reported, the latter organism also attacking *Albizzia* sp. [ibid., xvii, p. 301]. A fungus allied to *Rhizoctonia* [*Corticium*] *solani* infected *Centrosema pubescens*, inoculation experiments on which with the pathogen gave positive results. Improved drainage reduced the incidence of infection. *F. lignosus* was observed locally on gambir [*Uncaria gambier*] roots [ibid., ix, p. 126].

MÜLLER (A. S.). **El reconocimiento de las enfermedades de las plantas cultivadas en Venezuela, 1937–1941.** [Survey of diseases of cultivated plants in Venezuela, 1937–1941.]—*Bol. Soc. venez. Cien. nat.*, vii, 48, pp. 99–113, 1941.

The following are among the records of particular interest in this list of some 250 out of the 350 plant diseases collected and studied in Venezuela during the period from 1937 to 1941. Witches' broom of cacao (*Marasmius perniciosus*) [*R.A.M.*, xxi, p. 7] occurs in a very destructive form over a limited area nearest to Trinidad, while another case of an important pathogen involving only a restricted zone is represented by *Monilia roreri* [loc. cit.], which is found only along the river Catatumbo, Estado Zulia. Pod rots are caused by *Phytophthora palmivora* and *Diplodia cacaoicola* [*Botryodiplodia theobromae*]. Inadequately and excessively shaded coffee bushes are attacked by *Cercospora coffeicola* and *Omphalia flavida* [ibid., xiv, p. 397] respectively. Rice is commonly, but not severely, affected by *Piricularia oryzae*, *Entyloma oryzae*, and *C. oryzae*, while the damage to sugar-cane from the leaf spots *Leptosphaeria sacchari*, *C. longipes*, and *Helminthosporium stenospilum* [*Ophiobolus stenospilus*] is likewise slight. Mosaic is the most virulent disease of tobacco, and also attacks the tomato and chilli crops. *Phytomonas sepedonica* [*Bacterium sepedonicum*] is destructive on potatoes, especially in damp, low-lying situations. Streak and spindle tuber [ibid., xx, p. 221] are among the virus disorders of this crop. Leaf scorch of cucumbers is caused by *Peronoplasmopara* [*Pseudoperonospora*] *cubensis*. Bananas of the 'topocho' ['plump'] and 'manzano' ['apple'] types are threatened with extinction by *Bacillus* [*Bact.*] *solanacearum*, which in certain districts also attacks Gros Michel: other pathogens of the crop include *C. musae*, *Cordana* [*Scolecotrichum*] *musae*, *Stachylidium theobromae*, and *Gloeosporium musarum* (the principal agent of storage rot) [ibid., xix, p. 551 *et passim*], while the presence of *Fusarium oxysporum cubense* is suspected in one locality only. Papaw mosaic [ibid., xx, p. 565] is responsible for heavy losses, except in the Andes, *Colletotrichum papayae* [*C.*? *gloeosporioides*: ibid., xxi, p. 149] causes havoc in storage, and *Asperisporium caricae* [ibid., xxi, p. 88] is prevalent on the foliage. Among the citrus diseases may be mentioned foliar spotting due to *Septoria citri*, *Ascochyta citri*, and *C. gloeosporioides*, lemons and oranges being attacked by *Sphaceloma fawcettii* [*Elsinoe fawcetti*: ibid., xix, p. 366]. *Thielaviopsis* [*Ceratostomella*] *paradoxa* is the only important pathogen of pineapple. Fungi parasitic on the vine include *Cercospora viticola*, *S. ampelinum*, [*E. ampelina*], *Phakopsora vitis* [ibid., xv, p. 401], and *Guignardia bidwellii*.

Mosaic is the sole important gladiolus disease. Carnations suffer severely from rust (*Uromyces caryophyllinus*), and leaf spot (*Septoria dianthi*) is widespread. *Entyloma dahliae* is prevalent among garden dahlias, and *Pelargonium zonale* is frequently affected by foliar lesions due to *C. brunkii*. Powdery mildew of roses (*Oidium leuconium*) [*Sphaerotheca pannosa*] is severe throughout the year, while *Mycosphaerella rosicola* [ibid., xix, p. 348], *Actinonena* [*Diplocarpon*] *rosae*, *Sphaceloma rosarum* [ibid., xix, p. 366] and *Phragmidium subcorticium* [*P. mucronatum*] are also commonly encountered, the last-named in a severe form on certain varieties. Zinnias are attacked by *C. atricincta* [ibid., xvi, p. 128].

Elrod (R. P.). **Serological studies of Erwineae. II. Soft-rot group; with some biochemical considerations.**—*Bot. Gaz.*, ciii, 2, pp. 266–279, 1942.

Continuing his serological studies at the Ohio State University on the Erwineae [*R.A.M.*, xxi, p. 186], the writer tested in 26 fermentable substances 18 cultures of the four species comprising the soft-rot group [ibid., xxi, p. 42] from various sources, namely, five of *Erwinia aroideae*, three of *E. phytophthora*, two of *E. melonis*, two of *E. solanisapra* (one as *Bacillus atrosepticus*), and six of *E. carotovora* (two as *B. dissolvens*).

Classified on the basis of maltose fermentation, eight of the organisms fermented the sugar, six with both acid and gas formation and two with that of the former only, the maltose-negative cultures being correlated in 33·3 per cent. of the cases with maltose-negative antisera, while 28·6 per cent. of cross-reaction was demonstrated between the maltose-positive strains and the corresponding antisera. There was only 7·5 per cent. cross-reaction between the two fermentative groups, while the cross-agglutination experiments with 13 antisera were positive in 18·1 per cent. of the cultures, mostly within the same two groups. The correlation between maltose fermentation and serological groups would appear to support the contention, e.g., of Miss Lacey [ibid., v, p. 407] and Dowson [ibid., xx, p. 451], that two soft-rot pathogens exist, but the fermentative properties and antigenic structure of representatives of the two groups showed considerable variation.

Besides maltose, sorbitol was the only one of the substances used offering any possibilities of natural separation, and these seem to call for further investigation. It was broken down exclusively by the six cultures producing an abundance of gas. Stapp [ibid., viii, p. 397] obtained negative results in fermentation tests on sorbitol with strains of *E. phytophthora*, *E. carotovora*, and *E. solanisapra*.

The common antigenic components of the soft-rot group were shown to reside in the flagella. Adsorption experiments revealed a large number of flagellar components. The somatic fractions were found to be type-specific, though there was some evidence of common somatic factors. Like the somatic fractions, the carbohydrate materials extracted from the organisms proved to be type-specific, and the former are believed to owe their specificity to the latter.

Burkholder (W. H.). **Three bacterial plant pathogens: Phytomonas caryophylli sp.n., Phytomonas alliicola sp.n., and Phytomonas manihotis (Arthaud-Berthet et Bondar) Viégas.**—*Phytopathology*, xxxii, 2, pp. 141–149, 1942.

Three bacterial plant pathogens are fully described: two are new, viz., *Phytomonas caryophylli* n.sp., the agent of a wilt and root rot of carnations in Washington State, and *P. alliicola* n.sp., causing onion bulb rot in New York State, while the third, *P. manihotis* (Arthaud-Berthet & Bondar) Viégas, responsible for cassava wilt in São Paulo, Brazil, has hitherto been reported, without adequate diagnoses, under various incorrect names, including *Bacillus manihot* Arthaud-Berthet, *B. manihotus* Arthaud-Berthet (the 'u', according to Viégas *in litt.* being a typographical error for 'i'), *B. manihoti* Berthet & Bondar, and *Bacterium manihotus* Drummond & Hipolito [*Ceres*, Minas Geraes, ii, 10 pp. 280–307, 11 pl., 1941].

*P. caryophylli*, the symptoms due to which may simulate those of *Fusarium* wilt [*F. dianthi*], is a Gram-negative rod, 1·05 to 3·18 by 0·35 to 0·95 (average 1·84 by 0·56) $\mu$, actively motile by one to several flagella, frequently at both ends, forming on potato dextrose agar (the medium of choice) at 27° C. circular, smooth, glistening tan to grey-mauve, later brown colonies of a butyrous consistency; the minimum, optimum, and maximum temperatures for growth are 5°, 30° to 33°, and 46°; gelatine is slowly liquefied; indol and hydrogen sulphide are not produced; asparagin, potassium nitrate, and ammonium dihydrogen phosphate are utilized as sources of nitrogen; nitrates are reduced to nitrites; lipase is produced; carbon is supplied

by l-arabinose, d-xylose, rhamnose, dextrose, d-galactose, levulose, d-lactose, maltose, and sucrose, glycerol, mannitol, salicin, and the sodium salts of acetic, citric, formic, hippuric, lactic, maleic, malic, succinic, and tartaric acids; starch is not hydrolysed. These characteristics and the type of symptoms induced on the host leave little doubt that the causal organism differs from *P.* [*Bact.*] *woodsii* [ibid., xviii, pp. 413, 725], the only other bacterial pathogen known to attack the carnation. Inoculation experiments on Virginia carnations, *Dianthus barbatus*, and *D. allwoodii* gave positive results, *D. plumarius* remaining healthy.

The general appearance of the soft, water-soaked inner scales of onion bulbs infected by *P. alliicola* is not unlike that of those injured by frost; in the early stages of the disease the external aspect may be sound, but the microscopic examination of sections will reveal masses of bacteria. The organism is a Gram-negative rod, 1·05 to 2·8 by 0·7 to 1·4 (2·0 to 0·9) $\mu$, with one to several flagella (sometimes bipolar), forming on beef extract-peptone agar at 27° white, later dirty colonies, with wavy edges of a viscid consistency, while the agar becomes a deep brown (not developed on potato dextrose agar); the minimum, optimum, and maximum temperatures for growth are 5°, 30°, and 41°; the biochemical characters resemble those of *P. caryophylli*, except that rhamnose is a poor source of carbon and maleic acid is not utilized for this purpose. Inoculation experiments resulted in a brownish rot of carrots, firmer than that caused by *Erwinia carotovora*, a limited black rot of paper-white *Narcissus* bulbs, and a slight dry rot of tulip bulbs and iris rhizomes. Unlike the bacteriologically similar *P.* [*Bact.*] *solanacearum*, the onion pathogen retains its virulence fairly well in culture; moreover, it does not attack potatoes, while onions appear to be immune from *Bact. solanacearum*: separation from an even more closely related organism, *P. gardeniae* Burkh. & Pirone, is indicated by the failure of *P. alliicola* to infect *Gardenia*. The pathogen probably belongs to the *Pseudomonas* group.

*Phytomonas manihotis* is a Gram-negative, probably non-motile rod, 1·4 to 2·8 by 0·35 to 0·93 (2·17 by 0·6) $\mu$, showing in one culture a few cells with a single polar flagellum, forming on beef extract-peptone agar ivory-coloured, smooth, shiny, watery colonies, and on potato dextrose agar an abundant, white to hyaline, very mucoid growth; the minimum, optimum, and maximum temperatures for development are 5°, 30°, and 38°, respectively; gelatine is liquefied; hydrogen sulphide is formed but not indol; nitrogen is supplied by ammonium salts but not by nitrates or asparagin; very poor growth with slight acid production was obtained with dextrose d-galactose, levulose, d-xylose, maltose, and sucrose as sources of carbon, better results with an alkaline reaction being afforded by the salts of acetic, citric, malic, maleic, and succinic acids; starch is not hydrolysed. The exact taxonomic position of this organism calls for further studies.

Koehler (B.). **Effect of storage on yields of farm seed treated for disease control.**—*Bull. Ill. agric. Exp. Sta.* 476, pp. 259–276, 3 figs., 1941.

In experiments carried out in Illinois mainly to ascertain what adjustments are necessary in the dosage of mercurial disinfectants applied to cereal seed which is to be stored for different periods after treatment, ¼ oz. new improved ceresan applied two or more weeks before sowing gave at least as good control of loose and covered smuts of oats [*Ustilago avenae* and *U. kolleri*], barley scab and blight [*Gibberella saubinetii*], and wheat stinking smut [bunt: *Tilletia caries* and *T. foetida*] and at least as good yields of grain as ½ oz. applied one day before sowing. The treated seed was stored for periods ranging from several hours to 67 days, and had a moisture content of under 13 per cent. while in storage.

In nine years' experiments with maize various organic mercury disinfectants were used, at the rate of 1½ oz. per bush., and the periods of storage ranged from one day to one year. Some of the treated seed was stored with moisture contents of

17, 15, and 12 per cent. Contrary to the results with seed of small grain, seed maize was not damaged when the same rate of mercurial disinfectant was applied one year before sowing as was used when the treated seed was stored for one day. Maize from seed stored at 17 and 15 per cent. moisture gave yields inferior to those from seed stored at 12 per cent. moisture. This was true of both treated and untreated seed, indicating that the difference in yield was due to moisture effect only. New improved ceresan reduced to 1 per cent. ethyl mercury phosphate with maize starch gave results similar to those obtained with new improved semesan jr. Red copper oxide was slightly better than other disinfectants for protecting seed maize against soil-borne infection when the seed coat was broken, but it was rather less effective than some organic mercury disinfectants in controlling seedling blight due to *Diplodia* [*zeae*].

The following recommendations are made. Treated or not, small grains stored for seed purposes should not contain over 13 (preferably 12) per cent. moisture. New improved ceresan is recommended for wheat, oat, and barley seed. When the seed is to be stored for two weeks or more, only $\frac{1}{4}$ oz. should be used per bush. Wheat seed darkened by bunt and not re-cleaned before treatment requires $\frac{1}{2}$ oz., even if the disinfectant is applied several weeks before planting; if treatment is effected a day or two before planting 1 oz. should be used.

Copper carbonate (2 to 3 oz. per bush.), basic copper sulphate (2 oz.), and red copper oxide ($1\frac{1}{2}$ oz.) give good control of seed-borne diseases of wheat, and of hull-less oats and barley. The full dosage must be used whether the grain is to be stored or not.

Against maize seedling diseases new improved semesan jr and barbak-C are recommended. The treated seed can safely be stored for six months to a year, provided the moisture content is not too high and the seed is protected against high atmospheric humidity. Mercurial disinfectants should not be used in excess of an amount that will adhere to the seed maize, usually about $1\frac{1}{2}$ oz. per bush.

Mundkur (B. B.), Pal (B. P.), & Bose (R. D.). **Studies in Indian cereal smuts. II. Varietal resistance of Indian and other Wheats to loose smut. III. Varietal resistance of Indian and other Wheats to flag smut. IV. Varietal resistance of Indian and other Oats to smuts.**—*Indian J. agric. Sci.*, xi, 5, pp. 675–702, 1 pl., 1 fig., 1941.

In continuation of their initial studies on the principles underlying the breeding of cereals for smut resistance in India [*R.A.M.*, xviii, p. 585], Mundkur and Pal report and tabulate the results obtained to date in the development of wheat varieties resistant to loose smut (*Ustilago tritici*) and of varieties resistant to flag smut (*Urocystis tritici*), and Bose and Mundkur of oats resistant to loose and covered smuts (*Ustilago avenae* and *U. kolleri*).

Loose smut of wheat is controllable by the hot-water treatment, involving four hours' immersion at 26° to 27° C., followed by ten minutes at 53° to 54°, but since this method is apt to impair the viability of the seed-grain, preference should be given to the development of resistant varieties. Each of the 97 varieties tested for this purpose from 1936 to 1940, first at Pusa and then at New Delhi, was inoculated by M. B. Moore's method with a spore suspension *in vacuo* [ibid., xv, p. 567]. Throughout the trials three stocks of the Australian variety Federation and two of its hybrids, I(mperial) P(usa) 114 and IP 124, remained immune, while other crosses of mixed Australian and Indian parentage were highly resistant, including IP 120, 121, 122, and 165. Selection within several semi-susceptible varieties, e.g., IP 120 and 121, resulted in the production of highly resistant or immune segregates, but similar attempts with highly susceptible but economically valuable varieties were unsuccessful.

Ninety-seven Indian and other wheat varieties were inoculated by a method entailing the contamination both of the soil and of the seed-grain with *Urocystis tritici*,

which is prevalent in parts of the Punjab, the North-West Frontier Province, Baluchistan, and southern Afghanistan, causing substantial reductions of yield and decreasing the germinability of the seed by up to 63·7 per cent. During the three years of the trials (1938 to 1940), six varieties remained completely immune from flag smut, viz., 111–2–6, 111–2–8, 111–2–9, Geerlying, German, and Hornblende, while a number of others, including IP 4, IP 111, 111–2–3, 111–2–4, Sword, Igachikugo, Dundee, Baringa, Genoa, Peragis, Florence, and C5271–W1 showed a high degree of resistance, with only 0·4 to 1·8 per cent. mild infection.

The outcome of these experiments is considered to afford some indication of physiologic specialization in *U. tritici* [cf. ibid., xviii, p. 169]. Thus, Pridham and Dwyer found the Ranee and Florence varieties susceptible in Australia [ibid., ix, p. 770], Baringa and Gullen being classified as moderately resistant: at New Delhi all four varieties contracted only 1 to 2 per cent. infection. On the other hand, Nawaba and Ford, which were extremely resistant in Australia, developed 3·7 and 7·4 per cent. infection, respectively, in the Indian tests, while Firbank, resistant in Pridham and Dwyer's trials, showed 9 per cent. flag smut in the authors'. Hence it would appear that the Australian and Punjab races of the smut are distinct.

*Ustilago kolleri* is stated to be much more widely distributed on oats in India than *U. avenae* [ibid., xiv, p. 160]. Both smuts are amenable to seed treatment, particularly good results having been obtained in the case of the former by the formalin dry spray method [loc. cit.]. However, the resistance of certain varieties to *U. kolleri* observed in the course of breeding work led to a study on the nature of this reaction, involving a series of experiments initiated at Pusa in 1932–3 and concluded at New Delhi in 1938–9, in which attention was chiefly directed to covered smut as the more important of the two. The rapid loss of germinability in *U. kolleri* after the fourth month may be prevented by wrapping the smutted ears in blotting paper and storing them at a temperature of 12°. The seeds of all the 60 Indian and foreign varieties included in the tests were dehulled before inoculation, which was carried out four days previous to sowing. In 1932–3 nearly all the foreign varieties were immune or virtually so, whereas in 1935–6 only five (Kinwada S10, Nebraska 21, Iowar 670, Gopher, and Kanota), in 1936–7 three (Kinwada S10, Nebraska 21, and Gopher), and in 1938–9 two (Abundance and Gopher) remained free from infection. Of the hybrids between Indian and foreign varieties, I–207–95 was immune in 1935–6 and 1936–7 and showed 0·7 per cent. infection in 1938–9, the corresponding figures for VII–408 being 0, 0·7, and 0, respectively. The erratic germination of the spores in 1933–4, 1934–5, and 1937–8 precluded the tabulation of experimental data. The physiologic race of *U. kolleri* used in these tests was determined by G. M. Reed as a new one, to which he has assigned the number 14.

In 1928–9 the incidence of *U. avenae* on uninfected seed sown dry of IP 1, IP 2, Pusa Farm, and Lyallpur was 0, 0·7, 0, and 7·6 per cent., respectively, the corresponding figures for seed soaked in water for two hours being 0·1, 11·6, 0·4, and 40·8 per cent., respectively, and for that immersed in a heavy aqueous suspension of spores for the same period 0·1, 14·5, 0·5, and 45 per cent., respectively. In 1929–30, ordinary seed of IP 1 and Lyallpur contracted 0·05 and 1·3 per cent. infection, respectively, the same soaked in water for two hours 0·65 and 22·5 per cent., respectively, seed inoculated before storage and sown dry 19·41 and 34·4 per cent., respectively, the same sown after two hours' immersion in water 66·9 and 78·1 per cent., respectively, seed inoculated with dry spores before sowing 18·2 and 25·7 per cent., respectively, and seed inoculated before sowing by a two-hour soak in an aqueous spore suspension 51·1 and 91·3 per cent., respectively. It is apparent from these results that the inoculation of hulled seed before storage and its immersion prior to sowing ensure adequate infection, but the most uniformly successful method consists in removing the hulls, smearing the seeds with spores, and germinating them in moist sand at a suitable temperature.

RODENHISER (H. A.) & HOLTON (C. S.). **Variability in reaction of Wheat differential varieties to physiologic races of Tilletia levis and T. tritici.**—*Phytopathology*, xxxii, 2, pp. 158–164, 1942.

A tabulated account is given of a series of trials, carried out at seven agricultural experiment stations from 1937 to 1939, to determine the range of variability in the reaction of the differential spring wheats, Ulka, Marquis, and Canus, to physiologic races L 1, 2, 3, 4, 5, 7, and 8 of *Tilletia levis* [*T. foetida*] and T 3, 4, 5, 7, 8, 9, and 10 of *T. tritici* [*T. caries*: *R.A.M.*, xvii, p. 164 and preceding abstract]. Ulka gave a uniformly susceptible response to all the races at each of the stations throughout the period of the tests, whereas the reactions of Marquis were so variable under differing environmental conditions (apart from the consistent resistance of spring sowings to T 9) that it would be classed as resistant, intermediate, or susceptible to the particular races concerned according to the locality. Canus varied in its reactions to the races to which it is susceptible, but maintained a uniform resistance to L 1, L 2, and L 4, at all the spring wheat stations.

It is believed that variations in environmental conditions modify the expression of genetic factors for the protoplasmic reactions of the host in diverse ways; in other words, the plant, rather than the pathogen, is the first to respond to external influences. The numerous inconsistencies exhibited by two of the three varieties tested exemplify the complexity of race identification and add to the difficulty of assessing bunt resistance in spring wheats. It is apparent from the data here presented that trials for varietal reaction should not be confined to a single station, since a given race may appear innocuous under the optimum conditions for infection prevailing, for instance at Aberdeen, Idaho, and assume major importance in another environment. Such was the case in 1938 with L 2, L 4, and T 7 on Canus and T 9 on Marquis which showed an average of 0·7, 0·2, 6·3, and 4·7 per cent. infection, respectively, by these races at all the spring wheat stations compared with 27, 12, 52, and 58 per cent., respectively, in autumn sowings at Pendleton, Oregon.

HAYES (H. K.). **Barley varieties registered, VII.**—*J. Amer. Soc. Agron.*, xxxiv, 3, pp. 281–282, 1942.

Of the three barley varieties approved for registration [cf. *R.A.M.*, xx, p. 356] in 1940, viz., Beecher, Reg. No. 12, Lico, Reg. No. 13, and Texan, Reg. No. 14, the last-named, developed from a selection from Composite Cross C.I. 5530 of winter barley made in 1933, is resistant to mildew [*Erysiphe graminis*] and moderately so to net blotch [*Helminthosporium teres*] in the field.

STANTON (T. R.) & MURPHY (H. C.). **Field studies of smut resistance in Oats.**—*J. Amer. Soc. Agron.*, xxxiv, 3, pp. 248–258, 1942.

Uniform tests of oats for resistance to loose and covered smuts (*Ustilago avenae* and *U. levis* [*U. kolleri*]) were conducted in various parts of the United States from 1935 to 1939, at nine experiment stations in the first year and at 13 to 15 in the four following, local collections of the pathogens being used at each nursery [*R.A.M.*, xxi, p. 251].

The Canadian and Gothland controls proved highly susceptible to nearly all the strains included in the tests, with averages of 73·86 and 36·92 per cent., respectively, the corresponding figures for the other check varieties, Richland, Monarch, Black Mesdag, Fulghum, and Red Rustproof (Appler), being 20·89, 19·93, 3·44, 13·39, and 0·56 per cent., respectively. Navarro C.I. 966 and Victoria C.I. No. 3531, tested for four and five years, respectively, remained free from infection throughout the trials, while a further 23 out of the 68 varieties and selections regarded as smut-resistant proved immune in all the years in which they were included. Generally speaking, the incidence of infection was low for all varieties during the period covered by the experiments, only 18 showing an average above 1 per cent. Of the various groups

of selections, that from the Victoria × Richland was the most resistant, while the Bond crosses were the most susceptible within the resistant category. Bond itself showed a certain amount of infection in each of the five years (average 1·12 per cent.), due to its susceptibility to the physiologic races attacking the Red Rustproof strains. Markton was free from smut in four out of the five years, the average of 1·68 per cent. in 1935 being attributed to mechanical admixtures.

STANTON (T. R.). **Registration of varieties and strains of Oats. XI.**—*J. Amer. Soc. Agron.*, xxxiv, 3, pp. 275–279, 1942.

Full particulars are given of three additional varieties of oats approved for registration since the publication of the previous list in March, 1941 [*R.A.M.*, xx, p. 357], viz., Otoe (early red) Reg. No. 98, Tama (early yellow) Reg. No. 99, and Marida (mid-season white) Reg. No. 100. Otoe is resistant to stem rust [*Puccinia graminis*], Tama to nearly all the physiologic races of crown rust [*P. coronata*], *P. graminis*, and the smuts [*Ustilago avenae* and *U. kolleri*], and Marida to most of the physiologic races of the smuts occurring in the north-west of the United States.

STEVENS (N. E.). **How plant breeding programs complicate plant disease problems.**—*Science*, N.S., cxv, 2465, pp. 313–316, 1942.

The author discusses, and illustrates by some striking concrete examples, the risks of extensive plant disease dissemination attendant on the now established practice of breeding for resistance to certain pathogens of economic importance. In his opinion it is impossible to test new varieties sufficiently to make sure that some of them will not prove very susceptible to some disease later on. The real test of a new variety can only be its culture in the hands of 10,000 to 20,000 farmers. In considering future possibilities regarding plant diseases in maize, notably the plastic bacterial wilt [*Aplanobacter stewarti*] with its many strains, and the very variable smut [*Ustilago zeae*], the author draws attention to the very general planting of hybrid maize, the acreage under which in 1939 was computed by H. A. Wallace (*New Repub.*, 8th November, 1939) at a minimum of 25,000,000, compared with 500,000 in 1935. In Maryland, for instance, Golden Cross Bantam (a composite of two inbred lines, Purdue 39 and 51) furnished 40 per cent. of the total canning crop, and the quantity of seed of this variety produced in 1937 amounted to 1,500,000 lb., as against 2,000 in 1932. Through such intensive selection the indigenous 'Indian corn' is undergoing gradual conversion from a freely cross-pollinated crop, with an almost unlimited capacity for adjustment to pathogenic organisms, into a synthetic product deprived of its natural powers of adjusting itself by continual crossing and variation to the variable parasites attacking it. The writer anticipates the development in hybrid maize of a disease relation approximating to that obtaining in wheat and involving wider fluctuations in losses than have hitherto been in the former crop.

STEVENS (N. E.) & CHAPMAN (R. A.). **Growth of Diplodia macrospora in media containing pure biotin.**—*Phytopathology*, xxxii, 2, p. 184, 1942.

The writers have recently found that the addition to the basal medium of pure crystalline biotin-methyl ester promotes the growth of the maize ear pathogen *Diplodia macrospora* [*R.A.M.*, xxi, p. 285], the optimum dosage being at the rate of 2 $\gamma$ per l., though some development occurred in the presence of only 0·5 $\gamma$.

ELLIOTT (CHARLOTTE). **Bacterial wilt of Dent Corn inbreds.**—*Phytopathology*, xxxii, 3, pp. 262–265, 1942.

A tabulated account is given of a series of inoculation tests at the Arlington Experiment Farm, Virginia, in 1939 and 1940 to determine the reaction to bacterial wilt (*Xanthomonas stewarti*) of 50 dent maize hybrids, with special reference to the

late leaf blight phase of the disease which is responsible for such heavy losses (up to 50 per cent.) in susceptible lines, besides enhancing their liability to stem rot (*Diplodia*) [*zeae*: *R.A.M.*, xii, p. 364]. With one exception all the inbreds were more susceptible to leaf blight with advancing maturity than to stalk injections with an aqueous suspension of three virulent cultures of the pathogen, to which at least 12 were very resistant and a number of others moderately so in both seasons. Seedling reaction to invasion by *X. stewarti* is not, therefore, a safe guide to the subsequent behaviour of the same lines at a later stage of growth. Field observations on resistance in 1939 and 1940 showed that the incidence of wilt among 15,000 dent seedlings in the former season amounted to only 1·5 per cent. compared with 27 per cent. in the sweet lines, the corresponding figures for 12,000 plants in the latter year being 0·7 and 35 to 46 per cent., respectively. The differences in the resistance of dent inbreds offer promising possibilities for the development of a corresponding character in hybrids of the same type, a matter of great importance, since selection along these lines is the only known method of combating the disease in its later stages.

**Fruit and vegetable protection.**—*Food Manuf.*, xvii, 4, p. 105, 1942.

A new synthetic wrapper for fruits and vegetables, known as 'pliofilm' and made of rubber hydrochloride, has been under investigation for some years at the Florida Agricultural Experiment Station, where it is reported to have given excellent control of fruit and vegetable storage disorders, including citrus stem-end rot [*Diplodia natalensis*], besides imparting a brilliant gloss to the fruit, preserving its vitamin C content, and reducing its moisture loss to 1 per cent. over several months' storage, compared with 10 per cent. for ordinary tissue wrappers under identical temperature and humidity conditions. By means of a special stretching process the wrap is fitted skin-tight to the fruit, thereby reducing both the amount and the cost of the material required. Up to 500 fruits can be wrapped per minute. The many advantages of 'pliofilm' (a report on which is expected from the Station) should more than offset the slight additional expense of the treatment.

Menon (S. K. R.). **Notes on the fall of immature Coconuts in Ceylon.**—*J. Coconut Ind.*, v, 3, pp. 87, 89–91, 1941.

Among the factors—physiological, meteorological, pathological, genetical, and predatory—contributing to the fall of immature coco-nuts in Ceylon may be mentioned the disease caused by *Phytophthora* [*palmivora*: *R.A.M.*, xii, p. 77], which is stated to occur in a chronic form in certain districts with a heavy rainfall, e.g., Kurunegala, Bingiriya, and Mawatagama. On the Denever estate of Messrs. Harrison & Crosfield, Ltd., in the last-named region, for instance, all attempts at control have proved unavailing, and visitors are astonished at the vitality and fecundity of the palms notwithstanding years of depredation by the pathogen.

Ray (W. W.) & McLaughlin (J. H.). **Isolation and infection tests with seed- and soil-borne Cotton pathogens.**—*Phytopathology*, xxxii, 3, pp. 233–238, 1942.

Particulars are given of a series of greenhouse tests conducted at the Oklahoma Agricultural Experiment Station to determine the relative pathogenicity of a number of seed- and soil-borne fungi to three cotton varieties, viz., Acala (1938 Oklahoma crop), Paymaster (1939 Texas), and D. and P.L.11A (1938 Mississippi), the organisms being inoculated into (*a*) sterile soil (2 parts loam, and one each of sand and sewer sludge) in which sterile seed was subsequently planted, and (*b*) cotton seedlings grown under sterile conditions in test tubes on water agar. The data were collected at the end of 28 days in most of the trials.

At an average temperature of 80° F. and with an ample water supply for the plants, the four most virulent pathogens were *Glomerella gossypii*, *Rhizoctonia* [*Corticium*] *solani*, *Fusarium scirpi*, and *F. moniliforme* [*Gibberella fujikuroi*] in the order

named [*R.A.M.*, xxi, p. 196]. In the excessively humid atmosphere induced by heavy and repeated watering (several times daily) at a temperature of 80°, all the organisms tested, especially *G. fujikuroi*, acquired an access of virulence, with the exception of *F. vasinfectum*. Conversely, a decline in pathogenicity was manifested by most of the fungi, excepting *Glomerella gossypii*, *C. solani*, and *F. scirpi*, in soils kept only just moist enough to maintain the growth of the seedlings. Plants transferred to the open (65°) after several days at 80° were severely attacked by *C. solani* and *F. scirpi*, the other fungi causing no serious injury under these conditions. *G. gossypii* and *C. solani* were responsible for considerable damping-off in soils rendered alkaline ($P_H$ 8·3) by the addition of lime, and were also injurious in those with an acid reaction (6·3) due to the incorporation of sulphur.

Since *G. gossypii* was shown to have the heaviest infection index (obtained by multiplying the percentage of severely diseased plants in each by three, moderately infected by two, and slightly attacked by one, totalling, and averaging), it was given an arbitrary weighted index of 100, the proportions to which of the other fungi concerned were as follows: *C. solani* 86, *F. scirpi* (isolate D) and its var. *acuminatum* 58 and 56, respectively, *F. chlamydosporum* [ibid., xiii, p. 593] 53, *G. fujikuroi* (isolate 110) 52, *F. vasinfectum* (27) 48, *F. scirpi* (44A) 47, *F. solani* 46, *F. equiseti* var. *bullatum* 46, *Sclerotium bataticola* (41) [*Macrophomina phaseoli*: ibid., xviii, pp. 25, 286] 45, *F. semitectum* 42, *G. fujikuroi* (115) 40, *F. vasinfectum* (24) 37, *G. fujikuroi* (18) 35, *F. vasinfectum* (27) 34, and *M. phaseoli* (R 37) 30. Of all these fungi *C. solani* is regarded as the most injurious to cotton seedlings in Oklahoma, where it is widely distributed in the soil, and (as also shown by Lehman in North Carolina) [ibid., xx, p. 60] very difficult to control.

SOKOLOFF (V. P.) & KLOTZ (L. J.). **Mortality of the red scale on Citrus through infection with a spore-forming bacterium.**—*Phytopathology*, xxxii, 3, pp. 187–198, 3 figs., 1942.

A denitrifying bacillus, apparently distinct from all other known micro-organisms and herein designated *Bacillus* C, was experimentally shown in the laboratory of the Citrus Experiment Station, Riverside, California, to be capable of invading and destroying adult red scales (*Aonidiella aurantii*) on lemons. The newly discovered organism is a Gram-positive, strictly aerobic, pluriflagellate rod, 6 by $1\frac{1}{4}$ $\mu$, forming spores in the equatorial position and bearing a certain resemblance to Dutky's Japanese beetle (*Popillia japonica*) pathogens [*B. popilliae* and *B. lentimorbus*: *R.A.M.*, xxi, p. 78]; it occurs singly and in pairs or chains and generally loses its motility after a few days on standard media; on aerobic plates growth was made from $P_H$ 4 to 9·5 and in liquid substrata from 6 to 9·3, with an optimum at 7·5, the optimum temperature for development in chitin suspensions being 30° C., with a range from 12° to 40°. *Bacillus* C was originally isolated from the soil. Mass infection of the insects, with 98 per cent. mortality, was secured by a minimum of 2 to 4, and preferably 16, hours' immersion of the fruits in the beakers containing either peptone-water cultures or suspensions of the bacillus in sterile tap water. The destruction of the scales was found to be accompanied by a significant reduction in their soluble nitrate content, to which the lethal action of the bacillus may conceivably be related.

HARRAR (J. G.) & MCKELVEY (J. J.). **Biological control of the Mealy Bug (Pseudococcus spp.).**—Abs. in *Phytopathology*, xxxii, 1, p. 7, 1942.

Highly satisfactory results have been obtained in laboratory and greenhouse experiments in the control of mealy bugs (*Pseudococcus* spp.) through the agency of a virulent, specific fungal pathogen, for which the name *Endosclerotium pseudococcia* is proposed [without a diagnosis], while observations in apple orchards also indicate a potentially high mortality from the same source. Evidence was obtained that the

fungus can destroy mealy bugs at all stages of development except the egg. Under unfavourable environmental conditions it produces highly resistant compound sclerotia, which remain viable for several months and are responsible for the persistence of the pathogen in the greenhouse and field.

HEIM (R.). **Observations sur la flore mycologique malgache. VI. Les champignons des Termitières. Première note: Basidiomycètes.** [Observations on the mycological flora of Madagascar. VI. The fungi of Termites' nests. First note: Basidiomycetes.]—*Bol. Soc. broteriana,* Ser. 2a, xiii (*1938–1939*), pp. 45–68, 2 pl., 6 figs., [? 1939].

An annotated list is given of eight Basidiomycetes found associated with termites' nests in Madagascar [cf. *R.A.M.*, xix, p. 405]. The author has limited his observations strictly to the taxonomic aspect of the species concerned, without entering into the problem of their biological relationships with the insects.

EMMONS (C. W.). **Medical mycology in Latin America.**—*Chron. bot.*, vii, 1, pp. 15–16, 1942.

The large medical centres of South America, where the relation of fungi to human disease has long been studied with interest, have furnished a steady flow of valuable contributions to the knowledge of mycoses of various types, some of the more important of which are here briefly outlined. Most of the recent investigations mentioned have been noticed in this *Review*.

EMMONS (C. W.). **The isolation of Coccidioides from soil and from rodents.**—*Publ. Hlth Rep., Wash.*, lvii, 4, pp. 109–111, 1942.

During the summer of 1941 *Coccidioides immitis* was isolated from five out of 150 soil samples collected in the desert near the village of San Carlos, Arizona, following J. D. Aronson's demonstration (in a paper in the press) that a very high percentage of native schoolchildren on the local Indian reservation were sensitized to coccidioidin. No human case of the disease caused by the fungus having been diagnosed locally and its rarity as a soil saprophyte established, a search for an animal reservoir appeared to be indicated. The susceptibility of deer mice (*Peromyscus*) to *C. immitis* having been demonstrated in laboratory experiments by the writer, 105 wild rodents were trapped in the locality, of which species of *Perognathus* appear to be the predominant hosts; their role in relation to the spread of infection remains for discussion in a subsequent paper.

NEGRONI (P.). **Mykologisches Studium des ersten südamerikanischen Falles von Histoplasmosis.** [A mycological study of the first South American case of histoplasmosis.]—*Rev. Inst. bact., B. Aires*, ix, pp. 239–294, 1940. [Abs. in *Zbl. Bakt.*, Abt. 1 (Ref.), cxl, 11–12, pp. 235–236, 1941.]

The cultural and morphological characters of a strain of *Histoplasma capsulatum* isolated from ulcers in a fatal case of histoplasmosis (the first in South America) during the patient's lifetime [*R.A.M.*, xxi, p. 290] are fully described.

DEY (N. C.). **Notes on common skin diseases. III. Ringworm of the scalp: favus.**—*Indian med. Gaz.*, lxxvi, 7, pp. 416–417, 1941.

Favus (*Achorion schoenleini* and *A. actoni*) [*R.A.M.*, xv, p. 579] is stated to be endemic in Kashmir, the Punjab, the North-West Frontier Province, and Rajputana, but seldom occurs in the eastern and southern parts of India. The disorder is mostly restricted to the lower classes: its symptoms are described and therapeutic methods briefly discussed.

RÁVNAY-PREININGER (T.). **Dermatomykosen.** [Dermatomycoses].—*Dermatologica* (formerly *Derm. Z.*), lxxxiv, 1–2, pp. 85–105, 1941.

This is a review, supplemented by bibliographical references, of outstanding recent contributions from various countries to the elucidation of different aspects of human dermatomycoses.

MORRISON (H. B.) & HILL (H. W.). **Observations on the rate of growth of Oospora lactis.**—Abs. in *J. Bact.*, xliii, 2, p. 271, 1942.

Butter containing an unduly large number of mycelial fragments of the milk mould, *Oospora lactis* [*R.A.M.*, xxi, p. 17], being subject to rejection under the regulations of the United States Drug and Food Administration, information concerning the rate of growth of the organism is of importance to cream- and butter-producers.

In a study at the Kentucky Agricultural Experiment Station the average time at room temperature for the production by ten colonies (each grown from a single spore) of 100 $\mu$ of mycelium was 10·71 hours, the corresponding periods for 500 and 1,000 $\mu$ being 14·21 and 15·28 hours, respectively, with time ranges for the three mycelial lengths of 5·6 to 17·1, 7·95 to 21·35, and 8·9 to 23·2 hours, respectively. At a temperature of 58° F. the periods required for the attainment by the mycelium of lengths of 100, 500, and 1,000 $\mu$ were 44·3, 59, and 65·7 hours, respectively, but after a length of 600 $\mu$ was reached, growth was almost as rapid as at 70° to 75°.

Logarithms of mycelial length plotted against time gave an almost straight line, indicating that the increase in protoplasm in colonies of *O. lactis* proceeds at a rate approximating to that obtaining in bacterial populations and other biological growth.

LAGONI (H.). **Vergleichende Untersuchungen über den mikrobiciden Effekt verschiedener Konservierungsmittel.** [Comparative studies on the microbicidal effect of various preservatives.]—*Zbl. Bakt.*, Abt. 2, ciii, 9–11, pp. 225–231, 1 graph, 1941.

The results of trials at the Prussian Dairy Experiment and Research Institute, Kiel, showed that the inhibitory action of diacetyl on nutrient agar cultures of various organisms responsible for butter and margarine spoilage, including *Candida albicans*, *Penicillium commune*, *Fusarium lactis*, and *Oospora lactis* [see preceding abstract], was almost as powerful as that of benzoic acid [*R.A.M.*, xii, p. 524 *et passim*], whereas sodium benzoate [ibid., xxi, p. 80] was less effective. In most cases a concentration of diacetyl of m/500 sufficed to eliminate the contaminants, *C. albicans* and *P. commune*, however, being more refractory and requiring a dosage of m/100 to produce comparable effects.

BAYLIS (G. T. S.). **Stem-break and browning (Polyspora lini) of flax in New Zealand.**—*N.Z. J. Sci. Tech.*, A, xxiii, 1, pp. 1–8, 4 figs., 1941.

During flax crop surveys in the Canterbury district of New Zealand in 1939 and 1940, the stem-break and browning disease caused by *Polyspora lini* (identified by J. Colhoun from a culture sent to Northern Ireland) was observed for the first time in the country, both oil- and fibre-yielding varieties being affected [*R.A.M.*, xix, pp. 643, 644].

Traces of the fungus had been detected in the seed of Liral Crown linen flax from North Canterbury and Marlborough in 1938 (A. E. Muskett's determination), though no symptoms were apparent in the crop. In the following year the Marlborough stands again presented a healthy aspect, but 11 out of the 28 in North Canterbury were attacked, and the post-harvest examination of seed samples revealed infection in eight additional lines. The damage caused by the disease was not severe. In varietal reaction tests at Lincoln three large-seeded selections of the oil-yielding Moose (13/28, 16/28, and 11/29) proved resistant, while Rio was apparently immune. The most susceptible varieties were the blue-flowered fibre-producing Liral Crown,

Stormont Cirrus, and Stormont Gossamer. Seed-borne infection was entirely eliminated by ten minutes' immersion of the seed in water heated to 126° F., the swelling of the mucilaginous coating liable to occur during this process being much reduced by the addition of 5 per cent. alum and entirely obviated by freely dusting the seed with hydrated lime and mixing 1 per cent. of the same with the steep.

LINN (M. B.). **Cephalosporium leaf spot of Dieffenbachia.**—*Phytopathology*, xxxii, 2, pp. 172–175, 1 fig., 1942.

A species of *Cephalosporium* responsible for a leaf spot prevalent on greenhouse plants of *Dieffenbachia picta* on Staten Island, New York, is described [without a Latin diagnosis] as *C. dieffenbachiae* n.sp. It is characterized on potato dextrose agar by a creeping, appressed, pulverulent, white, later cartridge-buff mycelium, composed of septate, branching hyphae, 2 to 4 $\mu$ in diameter; simple to one- or two-branched, continuous to septate, mostly straight conidiophores, 4 to 47 by 1·5 to 2 $\mu$, bearing acrogenously hyaline, ovoid to short-cylindrical, uni- to bi-, rarely tri- or quadriseptate conidia, 3 to 12·5 by 1·5 to 2·5 $\mu$, collecting in greyish-white, shiny, spherical heads, 5 to 12 $\mu$ in diameter. The fungus produces on the leaves greyish lesions with dark brown borders, mostly circular at an advanced stage of infection, when a diameter of 6 to 8 mm. may be attained. Elongated spots may occasionally be observed on the petioles, midribs, and stems under conditions specially conducive to the development of the pathogen, the initial invasion of which is effected through wounds, mostly inflicted by mealy bugs, on the young, convolute leaves. *C. dieffenbachiae* differs from *C. cinnamomeum* [*R.A.M.*, xx, p. 305] in morphological and cultural characters, and moreover, cross-inoculation experiments with the two species showed the former species to be non-pathogenic to *Nephthytis afzelii* (the host of the latter), while *C. cinnamomeum* failed to infect *D. picta*.

WEISS (F.), HAASIS (F. A.), & WILLIAMSON (C. E.). **Prestorage disinfection of Narcissus bulbs.**—*Phytopathology*, xxxii, 3, pp. 199–205, 1942.

Of the various fungicides so far tested for the control of basal rot of King Alfred narcissus [daffodil: *Narcissus pseudonarcissus*] bulbs (*Fusarium bulbigenum*) [*R.A.M.*, xix, p. 539] on Long Island, New York, the most effective are two mercury compounds, mercuric chloride plus 1 per cent. acetic acid (ethyl mercury chloride) and ethyl mercury phosphate (new improved ceresan) used at concentrations of 0·2 and 0·4 per cent., respectively, the former reducing the number of rotten bulbs (per unit sample of 50) after about two months' storage from 19·50 in the untreated controls to 7·50 and 7·75 in two lots (5 and 15 minutes' immersion, respectively), and the latter to 5·50 and 3·25 (2 and 5 minutes, respectively). The rot was better combated by treatments applied shortly after digging than by those delayed for longer periods, the protective action of new improved ceresan being practically lost after 15 days (22·25 diseased bulbs out of 50 compared with 5·17 in a batch disinfected three days after harvesting). On the other hand, the early treatments caused floral disfigurement, the incidence of which amounted to 90·4 per cent. in batches disinfected with new improved ceresan three days after digging, as against 0·7 per cent. after a 15 days' delay. Experiments are now in progress to secure a practicable compromise between the conflicting requirements of adequate control of the fungus and elimination of injury to the flowers.

JENKINS (ANNA E.). **Ascochyta majalis identified on Lily of the Valley in the United States.**—*Phytopathology*, xxxii, 3, pp. 259–261, 1 fig., 1942.

This is an expanded account of the writer's recognition in 1940, for the first time in the United States, of the lily of the valley disease caused by *Ascochyta majalis*, a note on which has already appeared [*R.A.M.*, xx, p. 208]. The spots scattered over the blade were elliptical or elongated, up to 2 cm. in length, Hessian brown (Ridgway)

on the dry specimen, sometimes with a purple margin, which in turn was usually surrounded by a somewhat indefinite bright green zone. The spherical to flattened pycnidia, strewn over the surface of the lesions and occupying almost the entire thickness of the leaf, bore bi- to tri- or quadricellular yellowish conidia with sticky walls. The fungus was grown in pure culture on potato dextrose agar. A comparison of the American and Italian (type) material of *A. majalis* revealed their complete identity. In one case part of a discoloured area on a leaf base gave rise in culture to an organism believed to be *Kabatiella microsticta*, previously reported on the same host from the United States [ibid., viii, p. 725] and Czechoslovakia, while it may also have been responsible for a lily of the valley disease in Germany attributed by Pape to a *Gloeosporium* [ibid., vi, p. 730].

WESTON (W. H.). **The conidial phase of Sclerospora noblei.**—*Phytopathology*, xxxii, 3, pp. 206–213, 1 fig., 1942.

The author's original diagnosis of the distinctive oogonial stage of *Sclerospora noblei*, a destructive parasite of the valuable native perennial fodder grass, *Andropogon australis*, in New South Wales [*R.A.M.*, ix, p. 320], is here supplemented by a technical diagnosis and discussion of the conidial phase, which has since been collected by R. J. Noble on successively unfolding leaves bearing pallid, linear streaks during the months of December, January, and February.

The well-developed, arbusculate conidiophores, 300 to 450 $\mu$ in height, are furnished with a basal cell, 68 to 110 by 8 to 13 (usually 90 by 10) $\mu$, exclusive of which the main axis measures 120 to 200 (170, not counting the basal cell) by 20 to 34 (usually 28) $\mu$, and produces two to four, ordinarily three, large primary branches, giving rise to secondary, tertiary, or rarely quaternary ones, terminating in tapering sterigmata, 10 to 15 $\mu$ long, which bear hyaline, obovoid conidia, 21 to 38·9 by 13 to 30·9 (25 to 32·9 by 19 to 22·9) $\mu$. These features relate *S. noblei* to the predominantly conidial species of the Orient, and place it in a position intermediate between the group with small, rotund conidia, exemplified by *S. maydis* and *S. sorghi*, and that characterized by larger, elongated to ellipsoid organs, represented by *S. philippinensis* and *S. sacchari*. Among other points of interest in connexion with *S. noblei* may be mentioned the regular occurrence of both reproductive stages on the same host (to which the pathogen appears to be limited), the production of the conidiophores at night when the plants are wet with dew, and the apparent restriction of the parasite to its indigenous Australian host.

BORTELS (H.). **Ergänzende Mitteilung über die Wirkung von Molybdän-Düngungen auf Luzerne im Feldversuch.** [Supplementary note on the effect of fertilizing with molybdenum on Lucerne in a field experiment.]—*Zbl. Bakt.*, Abt. 2, ciii, 9–11, pp. 129–133, 1 fig., 1 graph, 1941.

Experiments are reported and their results tabulated (cf. *Arch. Mikrobiol.*, viii, pp. 13–26, 1937) from which it appears that a deficiency of available molybdenum and possibly also of boron [*R.A.M.*, xxi, p. 143] in the soil of a field at the Biological Institute, Berlin-Dahlem, was responsible for poor yields, susceptibility to infection by *Phoma medicaginis* [= *Ascochyta imperfecta*; *Pleospora rehmiana*: ibid., xvi, pp. 184, 258] and a species of *Verticillium*, and to frost injury in Mahndorf Blue Victoria lucerne. In 1939 the yields (at the second cutting) of plots receiving boron (0·1 gm. per sq. m.) but no molybdenum, molybdenum (0·5 gm. per sq. m.) but no boron, and both elements were, respectively, 159, 146·8, and 162·5 kg. per plot of 8 by 8 m., compared with 150·7 for the untreated control, thereby confirming the observations of Dmitriev on clover in the U.S.S.R. (*Chemisat. socialist. Agric.*, x, pp. 80–81, 1938) to the effect that molybdenum and boron should be applied jointly in order to secure the best harvests. It should be noted that the test plots had already been treated with molybdenum in 1934, 1935, 1937, and 1938.

Norval (R.). **Paspalum dilatatum as a fodder crop.**—*Fmg S. Afr.*, xvii, 192, pp. 175–178, 1942.

In recommending *Paspalum dilatatum* as a fodder crop in South Africa, the author states that its use involves no danger at all of poisoning to animals from *Claviceps paspali* [*R.A.M.*, xxi, p. 22], as the fungus is present only after the seed has formed, by which time the hay should have been cut.

Lefebvre (C. L.) & Johnson (H. W.). **Collections of fungi, bacteria, and nematodes of grasses.**—*Plant Dis. Reptr*, xxv, 23, pp. 556–579, 1941. [Mimeographed.]

In the foreword to this 22-page list of fungi, bacteria, and nematodes of grasses in the United States, compiled from collections made or received by the authors, it is stated that specimens from different parts of the country differed widely in the type of disease they showed. Most of the grasses from the humid eastern and southern States showed one or more leaf spots. In the south-east, smuts and stem rust (*Puccinia graminis*) were very scarce as compared with the central and far western States. Ergots, however, were widespread and somewhat common, the two most frequently found being *Claviceps paspali* on *Paspalum dilatatum* and other *Paspalum* species [see preceding abstract], and *C. purpurea* on many genera of grasses. During each of the last four years, *C. paspali* was abundantly present from Virginia to Florida and westwards to Texas. Root rots do not appear to cause as much injury in the south-east as in the more western sections.

Allison (J. L.) & Chamberlain (D. W.). **Grass diseases in Wisconsin in 1941.**—*Plant Dis. Reptr*, xxvi, 1, pp. 19–22, 1942. [Mimeographed.]

Brief observations on the grass diseases observed in Wisconsin (chiefly in the nurseries at Madison) during 1941 are accompanied by a table showing the relative severity of the several pathogens on eight pasture grasses, and by a host index for the diseases affecting 14 hosts.

Blaser (R. E.), Volk (G. M.), & Stokes (W. E.). **Deficiency symptoms and chemical composition of Lespedeza as related to fertilization.**—*J. Amer. Soc. Agron.*, xxxiv, 3, pp. 222–228, 3 figs., 1 graph, 1942.

In a fertilizer test in 1939–40 on a Leon fine sand in the flat pine lands of peninsular Florida *Lespedeza* seedlings deprived of phosphorus were stunted, with short branching stems and leaves clumped closely to the main stem in an erect position. The colour of the dwarfed foliage ranged from a very dull, dark green to purple or purplish-green. Potash shortage was manifested by stunting and foliar mottling, followed by burning or browning from the tips downwards. Soil analyses revealed an insufficiency of readily soluble phosphorus, calcium, and potassium, all of which should be added, in doses of 450, 1,500, and 75 lb. per acre, respectively, to produce a satisfactory growth of *Lespedeza* on the sites under observation. The increase of phosphorus in the plants resulting from the application of this element to the soil was accompanied by a highly significant rise in the nitrogen content.

Kung-Hsiang (L.). **A physiological study of the susceptibility of the blushed and green sides of Apples to certain fungous rots.**—*Phytopathology*, xxxii, 3, pp. 239–245, 1 diag., 1942.

In inoculation experiments at the New York (Cornell) Agricultural Experiment Station in 1940 the blushed side of apple fruits of several varieties was more slowly rotted than the green side by *Penicillium expansum* and *Sclerotinia fructicola*, whereas *Physalospora malorum* [*P. obtusa*] and *Lambertella corni-maris* [*R.A.M.*, xv, p. 531] acted at a uniform rate on both sides. The slower rate of decay on the blushed side by *Penicillium expansum* and *S. fructicola* was found to be correlated with higher sugar and nitrogen and lower water contents and a firmer consistency of the tissues.

In connexion with the last-named property, it is suggested that the blushed side may contain a larger amount than the green of insoluble pectic substance, which would confer superior resistance to organisms penetrating the cell walls of their host by means of enzymatic action, e.g., *P. expansum* and *S. fructicola*.

Gallástegui (I.). **Tratamiento de invierno de Manzanos de sidra.** [The winter treatment of cider Apples.]—*Agricultura, Madr.*, xi, 117, pp. 17–19, 1 fig., 1942.

The principal fungous diseases against which cider apples require protection during the winter in Spain are those caused by grey rot (attributed to *Monilia* [*Sclerotinia*] *fructigena*), attacking the leaves, buds, and blossoms, and fruits, *Nectria galligena*, and *Armillariella* [*Armillaria*] *mellea*. Measures for control are briefly indicated.

Singh (L.) & Hamid (A.). **The cold storage of Pears (Bartlett) in the Punjab.**—*Indian J. agric. Sci.*, xi, 5, pp. 769–777, 1 pl., 1 graph, 1941.

Bartlett pears in cold storage at Lyallpur, Punjab, are subject to scald [*R.A.M.*, xix, p. 713] between 36° and 40° F., waterlogging at 32°, core breakdown [ibid., xvii, p. 468] at 36° and 40°, and low temperature injury below 32°. Infection by fungal pathogens, mostly the blue and green moulds [*Penicillium italicum* and *P. digitatum*], was of a mild order in the experiments described.

Smith (C. O.) & Smith (D. J.). **Host range and growth-temperature relations of Coryneum beijerinckii.**—*Phytopathology*, xxxii, 3, pp. 221–225, 2 figs., 1 graph, 1942.

During the season of 1940–1 the precipitation in southern California was approximately twice as heavy as in normal years, with a maximum in March and April, thereby providing ideal conditions for the development of *Coryneum beijerinckii* [*Clasterosporium carpophilum*] on stone fruits, the disease being observed in plantings at the Citrus Experiment Station on the foliage of *Prunus fenzliana*, *P. majestica*, and *P. umbellata*, and in commercial orchards on that of almond, apricot, Japanese plum [*P. japonica*] (very severe), and peach. Inoculation experiments with spore suspensions of pure cultures of the pathogen from peach, apricot, and almond gave positive results after an incubation period of a week or two on 35 *P.* spp., besides the above-mentioned, including cherry, *P. alleghaniensis*, *P. angustifolia*, *P. besseyi*, *P. bokhariensis*, *P. caroliniana*, *P. cerasifera* [*P. divaricata*], *P. davidiana*, *P. demissa*, *P. fremontii*, *P. hortulana*, *P. ilicifolia*, *P. kansuensis*, *P. lyonii*, *P. mahaleb*, *P. maritima*, *P. mexicana*, *P. mume*, *P. munsoniana*, *P. orthosepala*, *P. pissardi*, *P. pseudocerasus*, *P. reverchonii*, *P. salicina*, *P. serotina*, *P. spinosa*, *P. texana*, *P. watsonii*, and *P. yedoënsis*. In pure culture on glucose-potato agar, the optimum temperature for the growth of *C. carpophilum* was 19° C., with a minimum below 8° and a maximum between 27° and 30·5°.

Drummond-Gonçalves (O.). **A crespeirà do Pessegueiro.** [Peach leaf curl.]—*Biológico*, viii, 1, pp. 21–22, 1 fig., 1942.

Peach leaf curl (*Taphrina deformans*), though not at present of economic importance in São Paulo, has of recent years become widespread in the State, due in part, no doubt, to the cold, damp weather in the early stages of vegetation, but at least in equal measure to the introduction of superior commercial varieties lacking the natural resistance of the common native fruit. A dormant application of 1 in 8 lime-sulphur or 1 per cent. Bordeaux mixture is recommended as the most effective control measure.

Bodine (E. W.). **Further notes on the incubation period of the Peach mosaic virus.**—*Science*, N.S., xcv, 2462, pp. 256–257, 1942.

In order to obtain further information on the incubation period of the peach mosaic

virus [*R.A.M.*, xxi, p. 295], seeds were planted in November, 1940, in Mesa County, Colorado, and by the following 15th May the resultant seedlings, numbering about 400, had attained a height of 4 to 6 in. Twenty ft. to the west of the trial plot was a row of 30 three-year-old Elberta trees affected by the severe strain of the virus, which on 25th August was observed to have passed to 15 of the seedlings. Thus, under these conditions of natural spread during the spring the incubation period was barely 100 days. This manifestation of the disease has never been recorded in one-year-old Elbertas in commercial orchards, and only very rarely in two- and three-year-old trees of the same variety [ibid., xvi, p. 544]. A comparable incubation period has been demonstrated in the case of spring bud and graft inoculations, whereas those made at or after midsummer induced no apparent symptoms until the following season. It is evident from these studies that the development of foliar symptoms calls for the immediate removal of all diseased trees.

Blodgett (E. C.). **A systemic arsenic toxicity of Peach and Apricot on old Apple land.**—*Plant Dis. Reptr*, xxv, 22, pp. 549–551, 1941. [Mimeographed.]

Since 1936 young peach and apricot trees in old apple orchards in Idaho have been observed to suffer from leaf spot, shot hole (in extreme cases 'lace leaf'), and defoliation, due to the presence in the soil of arsenical spray residues. The interveinal spots or blotches appear at midsummer and subsequently the tissues, usually commencing at the margin, undergo necrosis and fall out, either while still green or after turning yellow in August or early September. The older leaves are first affected, sometimes leaving only tufts of young foliage at the tops of the branches. In severe cases defoliation is sufficiently premature to prevent the proper maturation of the crop, and the small, bitter fruits are worthless. Only rather young trees are seriously affected. Ample evidence is available to the effect that peaches in particular are highly sensitive to arsenical injury, which has caused their complete defoliation in several orchards in the State where they are interplanted with apples receiving insecticidal treatments. Further work is in progress on the disorder under discussion, which is apt to be confused with various other troubles induced by quite different factors, notably shot hole (*Coryneum* [*Clasterosporium*] *carpophilum*) and X disease.

Bodine (E. W.) & Kreutzer (W. A.). **Ring spot of Apricot.**—*Phytopathology*, xxxii, 2, pp. 179–181, 1 fig., 1942.

A virulent disease of apricot, first observed near Palisade, Colorado, in 1935, since when it has steadily assumed increasing importance on the Montgamet and Moorpark varieties, is characterized by an irregular foliar spotting, with marked vein-clearing, followed by necrosis and crumbling of the tissues, imparting a frayed and ragged appearance to the leaves, and the development on the fruits, from about a fortnight before maturity (mid-June) onwards, of crateriform protuberances, with water-soaked, later buffy-citrine (Ridgway) to finally red-purple or red-brown margins. The bumpy appearance of the affected fruits may be partially obscured by the ripening process, but reddish-brown blotches or ring spots remain, frequently accompanied by cracking of the discoloured areas and disorganization of the underlying tissues to a depth of $\frac{1}{16}$ to $\frac{1}{8}$ or down to $\frac{1}{4}$ in. Trees showing one infected limb or twig in a growing season invariably become completely diseased within a year or two, and in no case during a five-year observation period has recovery been made. The eradication of diseased trees in 1937 and 1938 entirely arrested the spread of infection. Negative results were obtained in grafting experiments designed to ascertain the possible implication of the peach mosaic virus in the apricot disease, but the typical symptoms of the latter developed after two years in nursery apricot trees into which buds from affected individuals were inserted. The ring spot is thus evidently of virus origin, in which symptom expression is delayed two years. The infective principle

appears to be distinct from that involved in the apricot mosaic described by Atanasoff from Bulgaria [*R.A.M.*, xiv, p. 368].

DARROW (G. M.) & WALDO (G. F.). **Strawberry culture: western United States.**—*Fmrs' Bull. U.S. Dep. Agric.* 1027, 26 pp., 17 figs., 1 map, 1941.

This bulletin (revised from the original publication of 1919) contains brief notes (pp. 22–24) on the diseases affecting the strawberry crop in the western United States [cf. *R.A.M.*, xix, p. 402; xx, p. 348]. Red stele [*Phytophthora fragariae*: ibid., xxi, p. 86] is most prevalent on the heavier soils of western Oregon and Washington; the Marshall variety is highly resistant. In central California *Verticillium* [*albo-atrum*: ibid., xi, p. 727] is responsible for losses involving up to 75 per cent. of the crop, especially in stands following other hosts of the same pathogen, e.g., tomato, potato, and raspberry. In the Santa Clara-Watsonville district of the same State yellows [xanthosis] has practically exterminated the Marshall variety, which has been largely replaced by Nick Ohmer. Crinkle occurs in Oregon, Washington, and California. The use of clean stock and the roguing-out of infected plants are the only known methods of combating the virus diseases.

KUNKEL (L. O.). **False blossom in Periwinkles and its cure by heat.**—*Science*, N.S., xcv, 2462, p. 252, 1942.

Through the agency of *Cuscuta campestris*, previously shown to be a vector of certain viruses [*R.A.M.*, xx, p. 590], the infective principle of false blossom of cranberry [ibid., xv, p. 238] was transmitted to the periwinkle (*Vinca rosea*), potato, tomato, tobacco, and *Nicotiana glutinosa*, the symptoms appearing in the first-named within a month from exposure to the parasite under favourable conditions. Transmission was further readily effected in all the new hosts by grafting.

Diseased periwinkles recovered completely from false blossom after a fortnight's exposure to a temperature of 40° C., which did not seriously impair the vigour of the plants, while a week sufficed to cure the tops only. Experiments are in progress to determine the suitability of this treatment for cranberries. In its response to heat in periwinkles the false blossom virus behaves similarly to that of aster yellows [ibid., xxi, p. 257].

MEREDITH (C. H.). **The effect of chemicals on Fusarium oxysporum cubense growing in the soil.**—*Phytopathology*, xxxii, 2, pp. 182–184, 1942.

Of a number of chemicals tested at the Glenleigh Laboratory, Friends' College, Highgate, Jamaica, for their toxicity to soil cultures of the agent of banana wilt, *Fusarium oxysporum* [var.] *cubense* [*R.A.M.*, xx, p. 543], the following may be mentioned: ethyl mercury iodide, the highest non-toxic and lowest toxic values of which were 0·0005 and 0·0025 per cent., respectively, formaldehyde (0·03 and 0·04 per cent.), mercuric chloride (0·04 and 0·05 per cent.), carbolic acid (0·37 and 0·75 per cent.), and sodium nitrite (0·1 and 0·5 per cent.), the comparable figures for Bordeaux mixture being 20 and 50 per cent., and for hydrated lime 5 and 6 per cent.

**Fungicides and pest destroyers.**—*J. Dep. Agric. Vict.*, xl, 2, p. 59, 1942.

The Standards Association of Australia has issued for public critical review a draft specification to be No. K.83 for Fungicides and Pest Destroyers, including suitable methods of sampling and analysis. The draft has been drawn up by the Australian Chemical Institute, and is now issued in the hope that all chemical manufacturing interests concerned and technical interests associated with farming will study it carefully and submit their views for consideration. The draft consists of three parts, viz. (i) schedule of requirements (including, among others, arsenicals, copper compounds, lime-sulphur solution, spraying oils and emulsions, and dusting sulphur), (ii) methods of sampling, and (iii) recommended methods of analysis.

Heuberger (J. W.). **Tenacity of protective fungicides.**—*Chron. bot.*, vii, 1, pp. 9–10, 1942.

Most of the author's experimental work on laboratory methods for the assessment of the degree of tenacity of protective fungicides, here briefly recapitulated, has been noticed from another source [*R.A.M.*, xx, p. 70], but some further points of interest may be mentioned. The inherent tenacity of a given preparation is usually believed to be increased by a reduction in the size of the individual particles constituting it, but a study of two copper sprays of identical chemical composition, the particles of one measuring 0·5 $\mu$ and those of the other 2 $\mu$, showed the smaller to be no more adherent than the latter. Red cuprous oxide, which is of a soft consistency, has been shown to possess a higher tenacity value than copper zeolite, with its hard particles. Fixed copper sprays of low solubility tend to be more tenacious than those of high solubility. Two materials are now on the market which exert a spreading action without decreasing tenacity, namely, SS–3, a rosin spreader-sticker, and SEC oil, a self-emulsifying cottonseed product. From the limited data available the latter appears to be the better of the two. A considerable amount of field work with both these spreaders has been done by J. M. Hamilton at the New York State Agricultural Experiment Station.

**Vlugschrift der Centrale Proefstations Vereeniging No. 5. Voorschrift voor de bereiding van Bordeauxsche pap.** [Pamphlet No. 5 of the Central Experiment Stations' Association. Prescription for the preparation of Bordeaux mixture.]—*Bergcultures*, xvi, 1, pp. 5–7, 1942.

Practical directions are given for the preparation of 1–1–100 Bordeaux mixture, suitable spreaders for use with which in the Dutch East Indies include liquid sandovit (Van Gorkom), igepon-T [*R.A.M.*, xix, p. 200], lethalate, agral (all at 0·2 per cent.), tabak spreader B.P.M. (0·15 per cent.), T.F.O. oil N.K.P.M. (0·4 per cent.), and the fruits of *Sapindus rarak* (one to two per l. mixture), while the following are effective adhesives: glue (lemka) at the rate of 3 to 5 gm. per l., resin-soda solution (20 c.c. per l.), calcium caseinate (40 c.c. per l.), and molasses (5 to 10 gm. per l.).

Boyd (O. C.). **The weather and disease situation in Massachusetts in 1941.**—*Plant Dis. Reptr*, xxvi, 1, pp. 2–10, 1942. [Mimeographed.]

Unusual weather conditions prevailed during the growing season in Massachusetts in 1941, when an early, warm, dry opening period was followed by an abnormally hot June, with a high, continuous wind from 8th to 11th, and an unevenly distributed rainfall, the total precipitation for the State being 9·34 in. above the normal, while in Essex County it fell to barely 60 per cent. of the mean; July was also slightly above the normal both as regards temperature and rainfall, whereas from August to October precipitation was deficient. Taking the season as a whole, it ranks as warm and dry, the increase in the mean temperature for the period from March to October being 7·1° F. and the mean deficit in rainfall for the same period 7·7 in. These exceptional factors were conducive to excessively severe outbreaks of certain plant diseases, e.g., angular leaf spot of pickling cucumbers (*Phytomonas* [*Pseudomonas*] *lacrymans*)—the heaviest and most widespread, especially in the Connecticut Valley, for twelve years; mosaic of the same host, directly associated, like bacterial wilt [*Erwinia tracheiphila*], with large populations of the striped cucumber beetle [*Diabrotica melanocephala*]; and bacterial ring rot [*Bacterium sepedonicum*] of potatoes, introduced from Maine [see above, p. 322] both on certified and uncertified seed. Among the diseases new to, or of rare occurrence in, Massachusetts may be mentioned red stele [core] of strawberries (*Phytophthora fragariae*) (mainly Howard 17), reported for the first time and confirmed by J. B. Demaree; *Bact. vesicatorium* [*Xanthomonas vesicatoria*] on Victor tomatoes in Worcester County, the first record for twelve years; cabbage yellows

(*Fusarium conglutinans*), occurring in a virulent form, also for the first time for twelve years, and causing 5 to 75 per cent. infection, with up to 25 to 30 per cent. loss, in Essex County, especially on the Penn State and Golden Acre varieties, a resistant strain of Copenhagen showing only mild symptoms. The high April temperature, 5·3° above normal, probably resulted in a corresponding access of warmth in the soil, which persisted through June and July, thereby affording unusually favourable conditions for the yellows fungus, which is reported to assume an active habit only above 63° and to flourish between 80° and 90° [*R.A.M.*, vi, pp. 265, 366].

Glabe (E. F.). **Preventing spoilage by mold and bacteria.**—*Food Industr.*, xiv, 3, pp. 46–48, 4 figs., 1942.

Recent investigations have shown that sodium diacetate, vinegar, monocalcium acid phosphate, and the calcium and sodium salts of propionic acid [*R.A.M.*, xxi, p. 256] act as inhibitors of mould (*Aspergillus niger*, *Rhizopus nigricans*, *Penicillium stoloniferum*, and *Monilia sitophila*) growth in bread, the annual loss from which in the United States has been computed by Pirrie (*Bakers' Wkly*, 9th June, 1934) at 100,000,000 loaves. Of 269 baking companies interrogated, in connexion with hearings on definitions and standards of identity for white bread and other bakery products, 221 (82 per cent.) reported trouble at various times with epidemics of mould in their plants.

**The diploid cell and the diploidisation process in plants and animals, with special reference to the higher fungi—criticism and rebuttal.**—*Bot. Rev.*, viii, 3, pp. 191–193, 1942.

A letter is printed from Miss Mary Noble to the effect that Dr. Buller's recent paper on diploidization [*R.A.M.*, xx, p. 588] contains misstatements concerning her work on *Typhula trifolii*, together with a reply from Dr. Buller.

**Agricultural research. N.-Pathology.**—*Rep. imp. Coun. agric. Res., New Delhi, 1940–41*, p. 36, 1942.

Vein-clearing is the first symptom of yellow vein mosaic of *Hibiscus esculentus* in the Bombay district, sharply delineated patterns being formed in the young foliage, except in severe cases, characterized by general chlorosis. All growth made subsequent to infection is dwarfed, and flowering and fruiting are sparse. The virus is transmissible by grafting and through the agency of *Bemisia gossypiperda* but not by the sap, and no indication of seed transmission has been obtained. The appearance of the symptoms was delayed by nitrogen or phosphorus deficient culture solutions. Chilli leaf curl has been shown to be caused by the feeding of *Scirtothrips dorsalis* on the young foliage, and not by a virus [*R.A.M.*, xviii, pp. 432, 433]. *Phaseolus lunatus* and *Dolichos* were each found to be affected by a new virus, the yellow mosaic of the former being transmissible by *B. gossypiperda* and the ordinary mosaic of the latter by means of the sap. Rugose mosaic of tomato causes dwarfing of the plants, foliar stunting, and thickening and wrinkling of the leaflets, which develop a faint mottle and tend to curl upwards; advancing maturity is accompanied by marked stunting of the shoots and leaflets and by shortening and pallor of the petioles. The virus is communicable by means of the sap and *B. gossypiperda*. *Datura fastuosa* suffers from a sap-transmissible virus causing a typical green foliar mottling.

Raper (J. R.). **Sexual hormones in Achyla. III. Hormone A and the initial male reaction.**—*Amer. J. Bot.*, xxix, 2, pp. 159–166, 6 graphs, 1942.

After referring to his earlier studies on the activity of hormones in initiating and co-ordinating sexual reproduction in *Achyla bisexualis* and *A. ambisexualis* (vide

*Science*, N.S., lxxxix, pp. 321–322, 1939; *Amer. J. Bot.*, xxvi, pp. 639–650, 1939; xxvii, pp. 162–173, 1940; and *Mycologia*, xxxii, pp. 710–727, 1940), the author gives a full account of experiments which demonstrated that the initiation of the entire sexual reproductive process is brought about through the production by the vegetative mycelium of the ♀ of hormone A, which induces the formation of antheridial hyphae on the male mycelium.

MAYER (A.). **Concerning the mosaic disease of Tobacco.** IVANOWSKI (D.). **Concerning the mosaic disease of the Tobacco plant.** BEIJERINCK (M. W.). **Concerning a contagium vivum fluidum as a cause of the spot-disease of Tobacco leaves.** BAUER (E.). **On the etiology of infectious variegation.—Translated from the German by J. Johnson.**—*Phytopath. Class.* 7, 62 pp., 7 pl., 1942. \$0·75.

The publication of translations of these four papers, which are well-known to all plant virus workers but read by few, will be welcomed by students of virus diseases and the history of science. There is a portrait of each author accompanied by a short biographical account by Professor Johnson.

JOHNSON (J.). **Virus nomenclature and committees.**—*Chron. bot.*, vii, 2, pp. 65–66, 1942.

The many individual proposals for the nomenclature and reclassification of viruses are deprecated as adding unnecessary complications to an already confused and still fluid situation. The work of the International Committee on Virus Nomenclature, at present suspended owing to world hostilities, will ultimately, it is hoped, lead to the universal adoption of a consistent scheme of terminology, pending which attempts to transfer the viruses already known from one category to another, or to give a final form to the names of newly discovered ones, are regarded as undesirable.

FAWCETT (H. S.). **Virus nomenclature.**—*Chron. bot.*, vii, 1, pp. 7–8, 1942.

The writer's arguments in favour of a Latin binomial system of virus nomenclature have already been summarized [*R.A.M.*, xx, p. 174]. They are here recapitulated, with special insistence on the choice of some characteristic effect of the virus on its host or other significant relationship as the basis of a name, which should not be derived merely from the specific or generic name of the diseased plant, since the latter practice might give rise to confusion where more than one virus attacks a particular host. For instance, taking *X* to represent any genus that may be selected, appropriate names would be *X. astri*, *X. zonatus*, *X. rubiginosum*, *X. lethale*, *X. erodens*, and *X. orientalis*, whereas such designations as *X. solani*, *X. persicae*, *X. medicaginis*, *X. betae*, *X. citri*, and *X. caricae* would be unsuitable and likely to lead to confusion.

GOWEN (J. W.). **Mutation in Drosophila, bacteria, and viruses.**—*Cold Spr. Harb. Symp. quant. Biol.*, ix, pp. 189–193, 1 graph, 1941.

The studies of the writer and his collaborators on the frequency of spontaneous variants in bacteria (including *Phytomonas* [*Aplanobacter*] *stewarti*) from maize [*R.A.M.*, xix, p. 468], the ordinary and aucuba mosaic viruses of tobacco, and *Drosophila melanogaster* showed the incidence of such aberrations from the type to be ordinarily low, but subject to increase on exposure to comparable doses of X-rays. The rates at which the mutants appear are of the same order of magnitude for all three forms, perhaps indicating a common basic structure for inheritance liable to departures from the normal course under the influence of appropriate stimuli.

**Anti-bacterial substances from moulds.**

Raistrick (H.) & Smith (G.). **Part I. Citrinin, a metabolic product of Penicillium citrinum Thom.**—*Chem. & Industr.*, lx, 47, pp. 828–830, 1941.

Oxford (A. E.), Raistrick (H.), & Smith (G.). **Part II. Penicillic acid, a metabolic product of Penicillium puberulum Bainier and Penicillium cyclopium Westling.**—ibid., lxi, 2, pp. 22–24, 1942.

Oxford (A. E.). **Part III. Some observations on the bacteriostatic powers of the mould products citrinin and penicillic acid.**—ibid., 4, pp. 48–51, 1942.

Oxford (A. E.) & Raistrick (H.). **Part IV. Spinulosin and fumigatin, metabolic products of Penicillium spinulosum Thom and Aspergillus fumigatus Fresenius.**—ibid., 11, pp. 128–129, 1942.

Oxford (A. E.). **Part V. The bacteriostatic powers of the methyl ethers of fumigatin and spinulosin and other hydroxy-, methoxy- and hydroxymethoxy-derivatives of toluquinone and benzoquinone.**—ibid., 17, pp. 189–192, 1942.

In the course of several years of intensive studies of the metabolic products of moulds [cf. *R.A.M.*, xv, p. 170] four were found to possess strong anti-bacterial properties [ibid., xx, p. 485; xxi, p. 216]. Citrinin, isolated in a pure state from *Penicillium citrinum*, and penicillic acid from *P. cyclopeum*, both inhibited the growth of *Staphylococcus aureus*. Tested on a large number of bacterial pathogens, citrinin proved particularly active against Gram-positive and penicillic acid against the coli-typhoid-*Salmonella* group of Gram-negative bacteria. Spinulosin, isolated from *P. spinulosum*, was found to be only a weak anti-bacterial agent, but fumigatin from *Aspergillus fumigatus* was very powerful, particularly against *Vibrio cholerae*, *Bacillus anthracis*, and certain strains of *Staphylococcus aureus*. Both substances were also obtained synthetically. In a test of 15 derivatives of toluquinone and 7 of benzoquinone on a number of Gram-positive bacteria, some were found to be considerably more bacteriostatic than fumigatin.

Thomas (R. C.). **Composition of fungus hyphae. III. The Pythiaceae.**—*Ohio J. Sci.*, xlii, 2, pp. 60–62, 1942.

An analysis, by both microchemical and macrochemical methods, of the mycelium of six species of *Pythium* obtained from the American Type Culture Collection (*P. debaryanum*, *P. vexans*, *P. ultimum*, *P. acanthicum*, *P. aphanidermatum*, and *P. spinosum*) and of three unidentified isolates of the same genus, all cultured on potato broth, showed that the hyphae of all these species had the same composition. The outer walls of young hyphae were found to contain pectic material, and when this was removed by immersion in suitable solvents, a layer of cellulose was disclosed beneath. Old mature hyphae were doubly refractive to polarized light and therefore devoid of pectic substances. The pectic material in young hyphae completely masked the cellulose and prevented reagents from reaching it. The cellulose was strongly impregnated with fatty acids and, therefore, incapable of fixing dyes. Fatty acids were easily removed by saponifying with alcoholic potash. Following dissolution of cellulose in ammoniacal cupric hydrate or a hydrolysis with 70 per cent. sulphuric acid, a solid residue was obtained which was identified as chitin.

Elmer (O. H.). **Prevention of Potato seed piece decay.**—*Amer. Potato J.*, xix, 2, pp. 19–23, 1942.

A tabulated account is given of a series of tests carried out at the Kansas Agricultural Experiment Station from 1935 to 1940 to determine the relative efficacy of various disinfectant treatments on the prevention of potato seed piece decay (largely due to a watery soft rot, apparently of bacterial origin), which was exceptionally

severe in the first year of the trials, with only 27·7 per cent. of the untreated material in a sound condition, but relatively mild during the succeeding period, when the corresponding average amounted to 79·5. The best control was obtained by a momentary dip of the uncut tubers in a mercuric chloride solution (3, 4, or 5 in 500) plus 1 per cent. hydrochloric acid, which gave averages of 99, 99, and 97·3 per cent. sound seed pieces, respectively. Yellow oxide of mercury (1 lb. in 15 gals.) was also effective, a momentary dip resulting in 94 per cent. healthy material in 1935 and an average of 96·9 per cent. in the five following seasons, the corresponding figures for five minutes' immersion in hot formaldehyde (1 in 120 at 125° F.) being 76·4 and 93·7 per cent., respectively. Among other preparations tested, red oxide of copper and calomel [mercurous chloride] failed to confer adequate protection, while preplanting suberization of the cut seed pieces likewise proved ineffectual. The acidulated mercuric chloride incidentally gave excellent control of *Rhizoctonia* [*Corticium solani*: *R.A.M.*, xxi, p. 263 and above, p. 322].

Beaumont (A.) & Large (E. C.). **Potato spraying in the south-west. Lessons from 1941.**—*J. Minist. Agric.*, xlviii, 4, pp. 235–240, 1942.

During 1941 potato blight (*Phytophthora infestans*) did not appear over most of Devon until the middle of August. Little rain fell in July, but much in August and the first week of September, and the blight attack was late and rapid. Since the season was also late, the foliage became infected when the maincrop varieties were in the middle of ware tuber production, and the loss of ware in unsprayed crops ranged from 2 to 5 tons per acre. At most of the 34 centres in Devon and Cornwall where spraying demonstrations were given there was no disease, or very little, in the tubers; at a few centres, where the soil was heavy, slight infection of the tubers occurred, but it was always less in the sprayed than in the unsprayed plots.

At every centre where two applications of Bordeaux mixture were made, good foliage protection resulted, and loss of crop was almost completely prevented. At one centre, for example, sprayed Majestic potatoes yielded 12·7 tons of ware per acre, as against 7·4 tons for the unsprayed. In other localities increases of from 2 to 4 tons per acre in yield of ware were obtained. In general there was a gain of over 1 ton per acre for every week that most of the sprayed foliage remained green after the unsprayed plants were all but destroyed.

As infection occurred so late, one spray, properly timed, was found to be sufficient. Spraying had its maximum effect when carried out just before the disease broke out in the locality concerned, so that very little protective deposit was washed off before the attack began. Timing was much more important than the kind of spray used. In one area Great Scot potatoes sprayed on 4th August gave a total yield (ware, seed, and chats) of 7·9 tons per acre, against 4·9 for the unsprayed, while in another King Edward potatoes sprayed on 12th August gave a total yield of 14·8 tons per acre, as against 14 for the unsprayed, the application having been delayed until after the attack had begun. Here and at three other centres it was found that spraying was effective as long as there were only two or three spots on each plant; it failed if delayed only two days after this, i.e., until there were more than a dozen spots on each plant.

Spraying ought not to be deferred until the disease has already appeared locally, unless there is absolute certainty that the acreage can be covered in time. Where two applications were made, one early, the other just before the outbreak, the second was the more effective. A single spray, six weeks to a month before blight appeared, invariably had some effect, and at some centres appreciably increased yield.

Arran Consul potatoes were treated on 30th June and 31st July with Bordeaux mixture (4–5(hydrated lime)–40), five proprietary wet sprays, i.e., ready-made Burgundy mixture (containing 15 per cent. copper and used at the rate of 7 lb. per

40 gals.), a yellow cuprous oxide spray containing 50 per cent. copper, and used at 2 lb. per 40 gals., two copper oxychloride sprays containing 50 per cent. copper, and used at the same rate, and one copper oxychloride spray, sold in liquid form, containing 15 per cent. copper and used at 2 pints per 40 gals., and two dusts, i.e., copper-lime containing 16 per cent. copper, and a cuprous oxide dust containing 17·5 per cent. copper, both being applied at 25 lb. per acre (the sprays being used at 100 gals. per acre). The total yields were, respectively, 16, 15, 15·1, 15, 14·5, 14·5, 13·9, 13·2, and 13·2 tons per acre, as against 13·2 tons per acre for the untreated controls. These results agreed with general experience at all the centres, and were supported both by observations on foliage condition during the whole course of the attack, and by chemical analyses of the deposit on the leaves after a month of rain. Freshly made Bordeaux mixture gave the best results on all counts. All the proprietary sprays gave good control. The dusts were ineffective.

In preparing the Bordeaux mixture the 40 gals. water were put in a wooden barrel, a pailful removed and the hydrated lime creamed in it, the granulated copper sulphate crystals were dissolved in the water in the barrel, and finally the lime solution added. In this way the bulk of the water was used to dissolve the copper sulphate as rapidly as possible and the galvanized pail did not come into contact with the copper solution.

Owing to its non-persistence, dusting was found to afford only a temporary protection. In one locality two dust applications when the leaves were moist with rain increased the yield of ware from 7·4 to 9·8 tons per acre, as against 12·7 tons per acre for two applications of Bordeaux mixture. This was the only passably good result given by dusting. Some details are given on spraying machines and spray costs. In Cornwall a good deal of contract spraying was done at 17*s.* 6*d.* per acre.

In 1942 growers in south-western England are advised to spray immediately warning of blight is published in the newspapers and to repeat the application three weeks to a month later.

Texera (D. A.) & Müller (A. S.). **La podredumbre anular o marchitez bacteriana de las Papas.** [Ring rot or bacterial wilt of Potatoes.]—*Agricultor venez.*, v, 57–58, pp. 27–30, 2 figs., 1941.

During the last two years potato ring rot (*Phytomonas sepedonica*) [*Bacterium sepedonicum*] has been observed in various parts of Venezuela [see above, p. 324], including certain valleys of the Táchira and on the mountains along the coast from Miranda to Yaracuy; in November, 1939, nearly 100 per cent. of the plants were affected in some of the fields round San Cristobal, while in others the average percentage ranged from 10 to 60. The disease was experimentally shown to be transmissible through the tubers, by means of an infected cutting knife, and by contact. Tomato and eggplant seedlings grown in pots previously occupied by diseased potatoes contracted ring rot within a month, whereas chilli plants remained healthy under the same conditions. The pots were then left unplanted and without water for four months, during which period the pathogen apparently died out, since the next lot of potatoes did not develop the disease. *Bact. sepedonicum* appears from preliminary tests to thrive equally in acid ($P_H$ 5·3 to 5·9) and alkaline (7·6 to 7·8) soils, and to be favoured by excessive irrigation.

Rodriguez (L.). **La 'alternariosis' de la Patata.** ['Alternariosis' of the Potato.]—*Bol. Inst. bot. Univ. centr., Quito*, i, 1, pp. 85–124, 6 figs., 1942.

This is a comprehensive study of the history, geographical distribution, economic importance, symptomatology, morphology, life-history, culture, taxonomy, epidemiology, and control of the causal organism of early blight of potatoes (*Alternaria solani*), with special reference to the environmental conditions prevailing in the provinces of Pichincha, Cotopaxi, and Tungurahua, Ecuador.

Acock (A. M.). **An examination of Mulder's rapid biological method for estimating the amount of available copper in soils.**—*J. Coun. sci. indus. Res. Aust.*, xiv, 4, pp. 288–300, 1 graph, 1941.

An investigation of Mulder's claims that mould fungi can be used to assess the availability of copper in soils [*R.A.M.*, xviii, p. 241] confirmed the observation that the spore colour of *Aspergillus niger* grown on copper-deficient media depends on the amount of available copper. It was ascertained that when soil suitably diluted with copper-free culture medium is used as the only source of copper, the resultant spore colour of cultures of *A. niger* can be used as an indicator of the amount of copper in the soil available to the fungus. From a study of 46 Australian soils it was empirically established that soil 'sound' in respect of copper can be distinguished from 'unsound' soils, since the availability of copper to *A. niger* apparently parallels that to higher plants. Of eight strains tested, *A. niger* Neuberg (ex Lister 2380) was found to be the most suitable for the purpose. The paper concludes with a full description of a modified form of Mulder's technique which is recommended, emphasis being laid on the need for partially sterilizing the soil before adding the cultures.

Leece (C. W.). **Downy-mildew of Sugar Cane and other grasses.**—*Tech. Commun. Bur. Sug. Exp. Stas Qd, 1941*, 5, pp. 111–135 (1–25), 13 figs., 1941.

After reviewing the history and distribution of sugar-cane downy mildew (*Sclerospora sacchari*) [*R.A.M.*, xx, p. 277], fully describing the symptoms, and discussing the question of transmission, the author gives a detailed account of work conducted (chiefly in Brisbane) from 1938 to 1941 in which different grasses were tested (by being planted in proximity to affected cane) for their ability to act as alternate hosts. The results [cf. ibid., xx, p. 230] showed that maize and teosinte (*Euchlaena mexicana*) were highly susceptible, while sorghum was moderately resistant; the development of leaf markings on *Sorghum halepense* and *S. sudanense* indicated that these can serve as alternate hosts, but no symptoms of infection appeared on *Panicum maximum* or its var. *coloratum*, *Brachiaria purpurascens*, *Echinochloa frumentacea*, *Pennisetum purpureum*, *P. typhoides*, *Chloris gayana*, *S. vulgare* (Egyptian wheat), and *Erianthus arundinaceum*.

The diseased maize plants were frequently very malformed and gave greatly reduced yields; mycelium was found in the seed, but infected seed produced healthy plants. Abundant conidia were present under favourable conditions, but no oospores were observed. Under controlled conditions the disease was readily transmitted from maize to sugar-cane [ibid., xix, p. 166].

The available evidence indicates that while maize is of little importance in the perpetuation of sugar-cane downy mildew, it is potentially a serious factor in rapid dissemination where a source of infection already exists. The prohibition of maize planting in the vicinity of diseased sugar-cane in the Bundaberg district has been followed by a marked reduction in incidence.

Chona (B. L.) & Padwick (G. W.). **More light on the red-rot epidemic.**—*Indian Fmg*, iii, 2, pp. 70–73, 1 pl., 1942.

During 1940–1 the epidemic of sugar-cane red rot (*Colletotrichum falcatum*) previously reported from northern India [*R.A.M.*, xx, p. 228] continued to rage in northern Bihar and the eastern United Provinces. It spread to new localities in these areas, and was also observed in the central and western United Provinces, e.g., at Fyzabad, Shahjahanpur, Bareilly, Moradabad, Lhaksar, and Saharanpur. Co. 213 was the variety mainly affected in the different places, but in northern Bihar Co. 210, 299, and 331 and in the United Provinces Co. 210, 290, 299, 331, 370, 393, 421, 442, 445, 537, and Co. S. 5 were also attacked, Co. 299 and Co. 331 to a considerable extent. Occasional infections of Co. 312 in Fyzabad, Lhaksar, and Moradabad, and of Co. 356 in Sidhwalia were also noted. The disease was present not only in low-lying,

badly drained fields, but over a vast area comprising a wide range of soil and climatic conditions.

In investigations into the part played by cane debris in setting up infection from the soil, Co. 213 setts were planted in large pots and affected cane material placed round the setts, no diseased debris being applied to the controls. Some three months later 20 shoots out of 87 in the infected pots had dried up, as against only one in the controls, *C. falcatum* being isolated from the setts and dying shoots. In a field test Co. 213, 419, 444, and 445 setts were planted, and affected material of Co. 537 applied as debris in the furrows. About ten months later some of the shoots had dried up and died; typical blotches were found on the stalks, and acervuli of *C. falcatum* were noted on the leaf sheath, leaf midrib, and rind. Pink spore masses were abundantly present on the uppermost setts enclosed in the leaf sheath. Only Co. 213 was affected when the observations were made, and no disease was present in the control plots.

A third test was conducted, on the March-planted crop of the 1940–1 season, using Co. 213, 299, 312, 313, 331, and 419 and applying diseased material of Co. 213 from Lhaksar. By the end of July, 11 shoots in Co. 213, 2 in Co. 299, and 7 in Co. 313 showed very severe infection. The central spindle was killed, and numerous patches of acervuli were found on the basal part of the spindle and the midrib of the first partly unfolded outermost leaf of the spindle; the lesions extended to the leaf lamina. In this spindle type of lesion infection appeared to be rising from the shoot below. Reisolations from the midrib lesions, the affected shoots, and the mother sett yielded typical *C. falcatum* of the light type.

When pure cultures of the fungus were applied to furrows planted with sugar-cane, infection again resulted, whereas the control plot remained healthy.

From these results it is clear that control depends not only on clean 'seed' but on clean soil as well.

Of about 700 diseased clumps examined in various fields in 40 different localities in the affected areas of northern Bihar and the eastern United Provinces, 207 showed nodal infection in the complete absence of basal infection. In most cases secondary infection was present though no borer attack was observed. Nodal infection makes the selection of 'seed' more difficult as incipient infections of this type may escape detection.

In about 1,000 isolations made from different areas, a light-coloured type of *C. falcatum* has predominated, with abundant sporulation [ibid., xxi, p. 162]. All isolations made before the present epidemic were of a dark type with sparse sporulation. There are indications that the new strain is more virulent than the old, particularly on Co. 213. Further work is in progress.

EDGERTON (C. W.), FORBES (I. L.), MILLS (P. J.), DUFRÉNOY (J.), & LUKE (W. J.). **The hot water treatment of Sugarcane. A report of progress.**—*Bull. La agric. exp. Sta.* 336, 27 pp., 1942.

This is a collection of papers on the experimental control of sugar-cane diseases by hot-water treatment in Louisiana.

I. L. Forbes (pp. 5–7) presents the results of experiments carried out in 1939 and 1940, in which treatment for 20 or 30 minutes in hot water at 52° C. completely controlled chlorotic streak [*R.A.M.*, xx, p. 178]. Thus, while no diseased plants appeared in plots planted with treated diseased setts of varieties C. P. 807, C. P. 28–19, and C. P. 29–320 in 1939 and of the two last-named in 1940, the figures for the untreated diseased plots of the same varieties at the end of 1940 and 1941, respectively, were 31·1 and 43·3 (two experiments), 31·1, 21·8 and 97·7 (two experiments), 26·59 and 31·25 per cent., respectively. The treatment also gave an appreciable increase in germination and in the rate of growth of both diseased and healthy canes.

C. W. Edgerton, I. L. Forbes, and P. J. Mills (pp. 7–8) state that in small scale experiments conducted during 1939 to 1941 yields of commercial sugar-cane varieties

treated against chlorotic streak [loc. cit.] with hot water at 50° and 52° for 20 or 30 minutes were either superior or equal to those of the untreated control (average of 23·48 tons of cane per acre following treatment at 52° as compared with 19·33 tons for the control in the first year; and of 27·15 and 27·26 tons following treatment at 50° and 52°, respectively, as compared with 27·26 tons for the control in the next year). Treatment at 45°, 54° and 56° resulted in reduced yields.

I. L. Forbes's investigations (pp. 9–10) into the effect of the hot-water treatment on the resistance of the cane to subsequent artificial infection by red rot [*Colletotrichum falcatum*: ibid., xxi, p. 303] showed that in every one of the ten commercial sugar-cane varieties used in the tests (representing all degrees of resistance and susceptibility to red rot within Louisiana canes) the red rot damage was much more extensive in the untreated canes. When canes were inoculated with the red rot fungus prior to hot-water treatment for 20 minutes at 52°, no trace of infection was found in any plants treated within two days of inoculation, whereas those treated three, four, and five days after inoculation showed definite lesions, though less well developed than in the untreated inoculated lots. These results are taken to indicate that the mycelium of the red rot fungus in well established lesions is not entirely destroyed by hot water. When spore suspensions of the red rot fungus were treated at 52° for 5, 10, and 20 minutes prior to inoculation into canes, no red rot developed in any of the plants, indicating that the spores were destroyed during treatment.

J. Dufrénoy (pp. 10–11) discusses the biochemical aspects of the hot-water treatment of sugar-cane. When tissues of cane treated at 52° for 20 minutes were immersed in certain indicator solutions such as ortho-diphenol, para-diphenol, catechol, and adrenaline, which normally become coloured upon the addition of oxygen, these solutions became coloured at a more rapid rate or more deeply, the results indicating that there was more available oxygen in the cells of treated canes. When the same test was applied after treatment at 60°, the solutions did not become coloured. When such tissues were inoculated with the red rot fungus, growth of mycelium occurred, but no red pigment developed. It is concluded that the ability of the cane tissue to accept, hold, and give up oxygen was destroyed at 60°.

W. J. Luke (pp. 12–27) gives the results of one year's co-operative field experiments among nine plantations on the control of chlorotic streak by hot-water treatment. It was found generally that treatment stimulated the germination of the buds. With regard to yields, a slight decrease occurred in some treated plots and an increase in others. However, the variety C.P. 29–320, which was included in all nine test fields, showed a decrease of yield following hot-water treatment only in the August planting (average decrease of 1·76 tons per acre, due largely to the failure of one plot), whereas in the September, October, and November plantings, the yield was increased by about 3·9, 3·7, and 3·0 tons per acre, respectively, in the treated plots.

Martin (J. P.). **Pathology.**—*Rep. Hawaii Sug. Exp. Sta., 1941* (ex *Proc. Hawaii Sug. Pl. Ass., 1941*), pp. 28–42, 1942.

In this report [cf. *R.A.M.*, xx, p. 424] it is stated that during 1941 the incidence of sugar-cane eye spot (*Helminthosporium sacchari*) in Hawaii was the lowest for many years. The rapid spread of the highly resistant varieties 31–1389, 32–1063, 32–3575, and 32–8560 has greatly increased control.

Brown stripe (*Cochliobolus stenospilus*), confined mainly to localized areas on Oahu and Kauai, showed no increase in severity. On Kauai, the variety 35–1458 was found to be highly susceptible. Control consists in planting resistant varieties and building up soil fertility.

Leaf scald [*Bacterium albilineans*] chiefly attacked Yellow Caledonia canes, 28–4291, and 29–3859. No infection has so far been seen by the author and C. W. Carpenter on 32–1063 or 32–8560, though one report was received that 32–8560 was affected on Hawaii. In varietal resistant tests both varieties remained unaffected, even when the

cuttings were experimentally inoculated. Plantings of both varieties in areas previously planted to Yellow Caledonia, where infection was very serious during dry spells, showed no sign of the disease.

Mosaic incidence is rapidly declining, as a result of the use of resistant varieties, the selection of only healthy planting material, weed control, and roguing. No mosaic has yet been noted on 32–1063 or 32–8560.

Field and laboratory studies on these and other sugar-cane diseases by C. W. Carpenter are reviewed. Many varieties were observed to tolerate brown stripe. In one field experiment highly significant losses in cane and sugar resulted when cuttings were planted affected by chlorotic streak, a major disease in some areas. When, however, diseased cuttings were subjected to hot-water treatment, marked gain resulted over the affected, untreated cuttings. All diseased or questionable planting material should be treated with hot water. The test also demonstrated that 31–2806 is more tolerant of chlorotic streak than P.O.J. 2878.

Several flats of thickly germinated seedlings showed localized patches of eye spot, and a species of *Helminthosporium* (possibly *H. sacchari*) was ascertained to be attacking the plants just above ground-level. Disease development was favoured by high moisture and rapid growth. The affected flats were isolated, and several applications of calo-clor (mercurous and mercuric chloride) were applied to the diseased plants, irrigation also being reduced. Infection was considerably checked, and no apparent injury resulted from the treatment.

Varietal resistance tests indicated that most sugar-cane varieties locally grown are commercially resistant to leaf scald. The disease was present in nearly every planting of Waipahu 153, which was used as a control, and in most of the plots the cane died out. The variety 36–4510 was susceptible. Severity was greatly increased in susceptible varieties by unfavourable environmental conditions.

When P.O.J. 2878 was grown under a partial shade of lath and sprinkled frequently with water some 'pokkah-boeng' (*Gibberella fujikuroi*) developed. The fungus is ubiquitous but only becomes serious in hot, moist weather. The variety 32–1063 is rather susceptible, but apparently sustains no appreciable injury.

*Pythium* root rot of sugar-cane, formerly attributed to *P. graminicola* [ibid., xx, p. 425], is now stated to be due to *P. arrhenomanes*.

In an investigation into sugar-cane physiological disorders, the varieties H 109, 31–2806, 32–1063, and 32–8560 were grown in a complete nutrient solution and in solutions lacking nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese, and boron, respectively. When any one element was omitted, growth and cane and sugar yields of each variety were depressed. Symptoms typical of the deficiency of each element developed on all varieties, but some were much more tolerant of certain deficiencies than others. Under field conditions the juice quality of a variety may be improved in specific areas by applying certain elements to the soil.

Other diseases investigated included red bread mould (*Neurospora sitophila*) [ibid., xix, p. 32] on sugar-cane in seedling flats, leaf spot of figs (*Cercospora bolleana*) [ibid., xvi, p. 823], crape myrtle [*Lagerstroemia* sp.] leaf mildew (*Uncinula australiana*), and snapdragon [*Antirrhinum majus*] rust (*Puccinia antirrhini*).

Arwidsson (T.). **Die in Schweden beobachteten Arten von Pucciniastrum Otth und verwandten Uredineengattungen.** [The species of *Pucciniastrum* Otth and related genera observed in Sweden.]—*Svensk bot. Tidskr.*, xxxvi, 2–3, pp. 100–107, 1942.

This is a critically annotated list of 22 Pucciniastreae [*R.A.M.*, xvi, p. 63] collected in Sweden, comprising species of *Hyalopsora*, *Melampsorella*, *Melampsoridium*, *Pucciniastrum*, *Thekopsora*, *Uredinopsis*, *Calyptospora*, and *Milesia* [*Milesina*]. *C. goeppertiana* [ibid., xviii, p. 491] was detected by T. Lagerberg in 1937 in the teleutospore stage on *Vaccinium vitis-idaea* on Öland, this being the first authenticated record for the country.

KARLING (J. S.). **Parasitism among the Chytrids.**—*Amer. J. Bot.*, xxix, 1, pp. 24–35, 47 figs., 1942.

A critically annotated list is given of nine Chytridiales parasitic on other members of the same family, five of which, belonging to the genus *Rozella*, cause marked local hypertrophy or septation, or both, of the host cell. One of the species under discussion is new (*R. rhizophlyctii*), and a new genus, *Rozellopsis* [without a Latin diagnosis], is erected to accommodate four species (one new) with biflagellate zoospores which cannot be included in *Rozella*. *Pleolpidium* is reduced to a synonym of *Rozella*.

CHARDON (C. E.). **Exploraciónes micológicas de la América tropical: un ejemplo de cooperación inter-americana.** [Mycological explorations of tropical America: an example of inter-American co-operation.]—*Bol. Soc. venez. Cien. nat.*, vi, 45, pp. 219–237, 1940.

An interesting account is given of the mycological surveys of tropical America which have been undertaken during the past 25 years, the countries visited with this end in view including Puerto Rico, the Dominican Republic, Colombia, Venezuela, and Minas Geraes, Brazil. In 1939 the arrival of H. H. Whetzel and M. F. Barrus in Venezuela gave a strong impetus to mycological activity in that country, the number of collections from which now exceeds 4,000. Much of the literature comprising the bibliography of 51 titles appended to the author's résumé has been noticed in this *Review*, but attention may be drawn to the presence in Venezuela of two destructive pathogens, *Cercospora musae* on bananas [see above, p. 327] and *Ustilago zeae* on maize, as well as of *Ligniera vasculorum*, known to act as a parasite of sugar-cane [*R.A.M.*, xvi, p. 409] (also in Puerto Rico). Among the outstanding results of the surveys are the addition to the mycoflora of the above-mentioned countries of 360 species of fungi, the compilation of a list of economic plant diseases, and the accumulation of a valuable herbarium of tropical mycology at Cornell.

TAMAYO (F.). **Exploraciónes botánicas en la Peninsula de Paraguaná Estado Falcon.** [Botanical explorations in the Peninsula of Paraguaná, Falcon State.]—*Bol. Soc. venez. Cien. nat.*, vii, 47, pp. 1–90, 18 figs., 1941.

Among the parasitic fungi collected by the writer in the course of a botanical survey of the Paraguaná Peninsula, Venezuela, in 1938–9, were *Cercospora sesami* on sesame [*R.A.M.*, xii, p. 296], *Puccinia purpurea* [? on sorghum], and *Physoderma zeae-maydis* [*P. maydis* on maize] all identified by A. S. Müller and C. E. Chardon.

WALKER (E. H.). **Recording localities on specimen labels.**—*Chron. bot.*, vii, 2, pp. 70–71, 1942.

A plea is made for accuracy and clarity in the attribution of localities on botanical specimen labels, objects which may be equally well secured by thorough and careful application of the old-fashioned 'distance and direction' method as by the various new and more complicated schemes lately propounded in the scientific literature, namely, Grassl's system based on latitude and longitude (*Bull. Torrey bot. Cl.*, lxiii, pp. 519–526, 1936); Reed's gridiron system (*Science*, N.S., xciii, 2403, p. 68, 1941); Hubrecht's and Erickson's system of latitudes and departures (ibid., 2412, p. 288, 1941); and Ives's system (ibid., xciii, 2422, p. 523, 1941). Distance should be given in the customary units of miles or kilometres, reckoned 'as the crow flies' from a particular city or town, calculating from the centre of the latter. Direction should be designated either by the points of the compass, or in degrees of departure from the north or any other cardinal point. It is important to select, as a point of identification,

some well-known place with a reasonable expectation of permanency. A typical record by this method would read, e.g., Md, Charles Co., 5·6 miles N. 21° E., or 5·6 miles N.NE., from Morgantown.

MATSUMOTO (T.). **Serological studies on the distribution and concentration of Tobacco mosaic virus in host plants. III. Measurement of virus 15–30 days after inoculation. IV. Measurement of virus 1–2 months after inoculation.**—*Trans. nat. Hist. Soc. Formosa*, xxxi, 214–215, pp. 306–313; 216, pp. 345–350, 8 figs., 1941. [Abs. in *Biol. Abstr.*, xvi, 3, p. 742, 1942.]

Continuing his studies on the distribution and concentration of the tobacco mosaic virus in its hosts after varying periods [*R.A.M.*, xx, p. 602], the writer found that the tops, growing tips, and roots contain less of the virus than the upper expanding leaves and the inoculated ones. Fifteen days after inoculation a small quantity of the infective principle occurs in the foliage below the inoculated leaves. The virus was observed to accumulate in larger amounts in the basal stems and light green areas of diseased leaves than in the upper stems and dark green sections. The midrib usually contains less of the virus than the leaf blade, but the content varies with the age of the leaves. One to two months after inoculation the virus is still most abundant in the inoculated leaves and those immediately above them. Between these and the expanding top there is a definite fall in the concentration, which increases at the apex and still more in the roots. Again the midrib generally contains less of the virus than the lamina, especially the pale green areas. The initially uniform distribution of the virus tends to become irregular as the plant matures.

**Service and regulatory announcements. List of intercepted plant pests, 1940.**—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 71 pp., 1941.

Lists are given of the pests and diseases intercepted on plant products entering the United States during the period from 1st July, 1939, to 30th June, 1940 [cf. *R.A.M.*, xix, p. 192; xx, p. 336]. A new feature of the present issue is the listing of the diseases (1) alphabetically under the scientific name of the pathogen, (2) under the host, and (3) according to the country of origin. Phytopathological interceptions of special interest are 17 of citrus canker (*Bacterium* [*Xanthomonas*] *citri*), including one on lemon from (?) Spain; six of *Oospora citri-aurantii* on lime from Brazil, Cuba, Guatemala, Haiti, and Mexico; 15 of *Cercospora musae* on banana, including records from Cuba and Honduras; one of *Papulaspora coprophila*, which was apparently responsible for the decay of an onion bulb from Mexico; and seven of tomato spotted wilt from Mexico.

An index to previous interceptions has been prepared and is being checked with a view to publication.

**Service and regulatory announcements October–December, 1941.**—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 149, pp. 96–103, 1942.

Particulars are given of the plant quarantine import restrictions obtaining in Malta and the Republics of Uruguay, Argentina, and Cuba.

**Legislative and administrative measures.**—*Int. Bull. Pl. Prot.*, xvi, 1, p. 4M, 1942.

PERU. While the agricultural authorities are exploring the possibilities of combating the 'spasm' disease of flax (*Sphaerella linorum*) by seed disinfection, the transport, sale, and sowing of seed produced in the Cajamarca Department is prohibited. Holders of seed originating in this region are required to notify the Department of Agriculture of all particulars concerning such stocks, and information must also be given of any sowings already made with seed produced in the prohibited zone.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW OF APPLIED MYCOLOGY

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Young (P. A.). **Varietal resistance to blossom-end rot in Tomatoes.**—*Phytopathology*, xxxii, 3, pp. 214–220, 1 fig., 1942.

The following tomato varieties were the most resistant to blossom-end rot [*R.A.M.*, xix, p. 169] in trials at the Texas Agricultural Experiment Station from 1937 to 1939: Blair Forcing, Break o' Day, Grothen's Red Globe, Long Calyx Forcing, Marglobe, Marhio, Marvana, Marvel, Michigan State, Newport, Pritchard, Surest Forcing, and the white-flowered selections from X-ray-treated seed (*J. Hered.*, xxxi, pp. 78–79, 1940). Riverside, Louisiana Red, and Buckeye State were highly susceptible, and a number of others intermediate in their response. In tests carried out in 1940 the disease was shown to bring about a reduction in yield, which was not, however, closely correlated with the number of affected fruits per plant, but seemed to depend on the differential fruit-setting capacities of individual varieties. There was no apparent connexion between the incidence of wilt (*Fusarium* [*bulbigenum* var.] *lycopersici*) or differences in the copper spray programme [*R.A.M.*, xvi, p. 420] and reaction to blossom-end rot among the varieties tested. In addition to the usual features of the disorder, including extensive sunken, brown, well-defined, necrotic lesions in the peel of the blossom-end and flattening of the fruits, an uneven surface, with the formation of brown areas, indicating disorganization of the underlying tissues, developed in the course of a rainy spell in June, 1940, mostly on the Buckeye State variety.

Barratt (R. W.). **Occurrence of Tomato leaf mold and of Muskmelon powdery mildew in the field in New Hampshire.**—*Plant Dis. Reptr*, xxvi, 2, p. 49, 1942. [Mimeographed.]

Rapid spread of tomato leaf mould (*Cladosporium fulvum*) was observed between 8th August and 1st September, 1941, in the field at the Durham (New Hampshire) Horticulture Farm, to which the pathogen is believed to have been carried on greenhouse-raised seedlings. Complaints regarding the disease were likewise received from home gardens procuring their plants from the same source. Muskmelons at the Farm were severely attacked by *Erysiphe cichoracearum*, which is also thought to have originated in the greenhouse.

Blood (H. L.). **Control of bacterial canker of Tomatoes.**—*Canning Age*, xxiii, 4, pp. 221–223, 2 figs., 1942.

The writer describes the symptoms of tomato bacterial canker (*Phytomonas michiganensis*) [*Corynebacterium michiganense*] and gives the following recommendations for its control, based on work conducted at the Utah Agricultural Experiment Station [*R.A.M.*, xiii, p. 478; xiv, p. 681]. Extract seed by thorough fermentation of macerated pulp for 96 hours at or below 70° F., stirring twice daily to keep the pomace submerged; treat extracted seed immediately by 24 hours' immersion in 0·8 per cent. acetic acid (0·6 per cent. for dried seed); use a clean seed-bed, all soil of sites on which

the disease has occurred being replaced to a depth of 10 to 12 in. by new soil after drenching the subsoil with 1 in 24 formaldehyde, which may also be used for washing all frames, sash, and covers; practise a minimum rotation of three years; and rogue out all diseased plants before harvest.

Horsfall (J. G.) & Heuberger (J. W.). **Measuring magnitude of a defoliation disease of Tomatoes.**—*Phytopathology*, xxxii, 2, pp. 226–232, 1 graph, 1942.

McKinney's rapid technique for computing the extent of infection by a plant disease [*R.A.M.*, iii, p. 330] was applied at the New York State and Connecticut Agricultural Experiment Stations in 1938 and 1940, respectively, to the defoliation disease [early blight] of tomatoes (*Alternaria solani*), the John Baer variety being used in the former and Scarlet Dawn in the latter series of trials. Each plant is examined by walking cross-wise through the plots and assigned an arbitrary number ranging from 0 (no disease) to 4 (total defoliation). The ratings are added, divided by the total number of plants multiplied by four, and the quotient is multiplied by 100 for conversion into percentage, which is designated index of infection. This somewhat subjective method of gauging infection was found to bear a linear relation to the following more objective modes of recording the incidence of disease on the same plots: (1) percentage of leaves killed by the fungus, (2) percentage of fruits invaded by stem-end rot, (3) weight of green plants less fruits at time of reading, and (4) weight of green fruits at the end of the season. By the means described three men rated seven copper spray treatments in precisely the same order of efficacy as compared with a control plot (except in one instance), showing the technique to be valid, accurate, and reasonably objective, at any rate for a single series of fields or plots in a particular season.

Costa (A. S.) & Forster (R.). **Identidade do virus de vira-cabeça e sua inclusão no grupo do virus do "spotted wilt".** [The identity of the 'vira-cabeça' virus and its inclusion in the group of the spotted wilt virus.]—*Bragantia, S. Paulo*, i, 7, pp. 491–506, 19 figs., 1941. [English summary.]

The writers tabulate and discuss the points of similarity between the viruses of spotted wilt, tomato tip blight [*R.A.M.*, xviii, p. 420], 'kromnek', 'corcova', Azevedo's tomato virus [ibid., xvi, p. 501], and 'vira-cabeça' [top necrosis: ibid., xx, p. 502], in respect of their physical properties, vectors, differential hosts, and host range, the conclusion being reached that the viruses in question, if not identical, are closely interrelated.

Del Cañizo (J.). **Spain. A new method of controlling ink disease of the European Chestnut.**—*Int. Bull. Pl. Prot.*, xvi, 1, pp. 2M–3M, 1942.

The ravages of the ink disease (*Phytophthora cambivora*) are stated to be rapidly decimating the valuable chestnut stands of Spain [*R.A.M.*, viii, p. 152; xv, p. 540], where there are at present about 5,000,000 trees in production. Even in the province of Lugo, one of the least affected, the number of trees has sunk to half within the last 25 years, in La Coruña it has fallen to a sixth of the figure recorded at the opening of the present century, and in Pontevedra this source of income is practically exhausted. At this rate of progress a substantial source of wealth will be rapidly closed. In the hope of averting this danger experiments have been carried out since 1934 by P. Urquijo Landaluze in five provinces in the control of the pathogen by the application to the underground portion of the trunk and root base of an insoluble copper salt (usually the carbonate) previously mixed with an adhesive liquid [loc. cit.]. The treatment proved effective. The cost, calculated on the basis of 1938 prices, for 156 trees in the Asturias was 1·20 pesetas per tree for the chemical and 1·40 for the unskilled labour required. So successful has the method proved that it was extended by the Department of Agriculture in 1941 to a large number of groves comprising

thousands of trees. *P. cambivora* is believed to have entered Spain from two foci of infection, one in France [ibid., xvii, p. 356] and the other in Portugal.

Leach (J. G.) & Rupert (J. A.). **Black canker of Willow in West Virginia.**—*Plant Dis. Reptr*, xxv, 23, p. 588, 1941. [Mimeographed.]

Black canker (*Physalospora miyabeana*) [*R.A.M.*, xviii, p. 827; xxi, p. 172] has been found on two weeping willows [*Salix babylonica*] near Thomas, Tucker County, West Virginia. The disease was known to be present in 1939, but was not definitely identified until the summer of 1941. The fungus was isolated from the affected tissues, and both the perfect and imperfect stages were found fruiting on the cankers. This appears to be the first record of the disease from West Virginia.

Cash (Edith K.). **An abnormality of Abies balsamea.**—*Plant Dis. Reptr*, xxv, 22, p. 548, 1941. [Mimeographed.]

In December, 1939, an abnormal condition of the twigs of *Abies balsamea* shipped to New York from Newfoundland was observed by the plant quarantine inspectors and specimens were intercepted for further study. Similar material was later secured at Buffalo on *Abies* from Nova Scotia, at Boston on *A. balsamea* from New Hampshire, and in Colorado (by R. W. Davidson) on *A. lasiocarpa*. The apical stems bore an abundance of staminate blossom buds, the development of the terminal one frequently being arrested, with the result that branching was abnormally dense. The scales surrounding the staminate cones formed in previous years were still attached to the slightly swollen twigs, though the cones had fallen out. No fungi or other micro-organisms could be found in most of the specimens; but those from Newfoundland harboured black, depressed-globose sclerotia, surrounded by the cup-like sheaths formed by the above-mentioned basal scales. These sclerotia may possibly belong to *Sclerotinia kerneri*, described on *A. alba* in Austria by Wettstein in 1887, though the closer identification of the North American organism must await the development of the apothecial stage.

Pierce (R. G.). **Spread of White Pine blister rust in southern Appalachian States in 1941.**—*Plant Dis. Reptr*, xxvi, 2, pp. 54–55, 1942. [Mimeographed.]

During 1941 the agent of white pine blister rust, *Cronartium ribicola*, spread from Raleigh County, West Virginia, to McDowell County, North Carolina, a distance of 134 miles, thereby adding a continuous belt of 16 new counties to those already known to harbour the disease, with a total of 35 fresh infection centres. White pines [*Pinus strobus*] appeared to be free from infection in all the counties, the species of *Ribes* attacked being *R. cynosbati* in West Virginia, the same and *R. rotundifolium* in Virginia and North Carolina, *R. americanum* at one locality in the latter State, and *R. cynosbati* in Tennessee [cf. *R.A.M.*, xii, p. 407; xvii, p. 639, *et passim*]. The minimum altitude at which the rust was found was 1,750 ft. and the maximum 5,000 ft. Fifteen of the 25 sites for which data on the aspect of the bushes are available faced north, north-east, or north-west. Favourable conditions for the spread of *C. ribicola* from pines to *Ribes* prevailed in the four States concerned in late April (warm to hot, rainy, cloudy weather) and June, with three continuous wet spells from 1st to 5th, 8th to 15th, and 23rd to 30th, while in north-western North Carolina the persistent rainfall of July and August facilitated the dissemination of the uredospores from bush to bush.

Most of the valuable pine stands within the newly infected zones were already protected by the initial eradication of *Ribes*, so that this further southward extension of the rust is of no particular importance in connexion with its control. A certain amount of damage and loss among the few scattered trees situated outside the confines of the control areas must be accepted as inevitable.

Haddow (W. R.). **Needle blight and late fall browning of Red Pine (Pinus resinosa Ait.) caused by a gall midge (Cecidomyiidae) and the fungus Pullularia (De Bary) Berkhout.**—*Trans. roy. Canad. Inst.*, xxiii, 2, pp. 161–189, 4 pl., 1941.

A full account is given of needle blight and late fall diseases of the foliage of red pine (*Pinus resinosa*) in Canada [*R.A.M.*, xix, p. 124], with which needle droop of the United States [ibid., xix, p. 445] is thought to be identical. The diseases may cause very severe defoliation, which could not be tolerated for many seasons. They are therefore potentially dangerous but where observed in Ontario they have come under natural control through parasitism before death of the trees resulted. A gall midge (Cecidomyiid) is the initiating agent of both diseases. Late fall browning is the result of injury caused by the larva of the gall midge alone, while needle blight results when there is infection of the bases of midge-infested needles by *Pullularia pullulans* (syn. *Dematium pullulans*, *Hormonema dematioides*, and *H. pullulans*).

The two diseases were not observed in natural forests; in forest plantations they occurred only in close, even-aged stands, mostly ten to twenty years old, needle blight being more favoured by wet and late fall browning by dry weather. Needle blight causes a bending of needles, which remain suspended in a hooked position on the lower branches as they drop, giving the trees an untidy appearance. The whole tree is usually affected by blight, but defoliation is slightly more severe towards the top and on the lower parts of branches. Extra-seasonal growth, sometimes leading to forking of the stem, either simple or multiple, is common, but rarely persists for many years. When scales were carefully removed from the blighted needles, dark, necrotic, and resinous lesions were exposed, from which *P. pullulans* was regularly isolated. Microscopic examination revealed the presence of the fungus in the mesophyll of the leaf, and both on the outside and the inside of the accessory foliar parts. The epidermal and hypodermal cells were sometimes discoloured, but mostly free from mycelium, as were also the vascular and transfusion tissues.

Typical needle blight occurs only when the bases of the needles are still succulent, which is usually in early summer. Late fall browning usually appears late in the season with great suddenness and intensity. Within a few days needles become completely brown from the base upwards and eventually die, without developing the bent or hooked appearance. A great measure of natural control was found to be exercised by Chalcid flies (mostly *Platygaster filicornis*) parasitic on the gall midge. It was also observed that spiders catching midges were unusually abundant in infested plantations.

Björkman (E.). **Renkulturförsök med snöskyttesvampen (Phacidium infestans Karst.).** [Pure culture experiments with the snow leaf fall fungus (*Phacidium infestans* Karst.).]—*Svensk bot. Tidskr.*, xxxvi, 2–3, pp. 120–123, 7 figs., 1942. [German summary.]

An account is given of the writer's preliminary experiments at the Institute for Physiological Botany, Upsala, and in the open in Hälsingland, Sweden, with the snow leaf fall fungus (*Phacidium infestans*), a destructive pathogen of pines in the north of the country [*R.A.M.*, xvii, p. 86]. In the spring of 1940 samples of diseased needles and of the characteristic mycelium commonly found on them were collected and transferred to malt agar plates. Of the three kinds of mycelia which rapidly developed, one from the interior of a needle was proved to be pathogenic so that an etiological connexion between the mycelium and the snow leaf fall disease may be presumed. The pathogenic mycelium was observed to bear the typical fruit bodies of *P. infestans*, and additional evidence of its identity with *P. infestans* was provided by the fact that it formed anastomoses with mycelium from *P. infestans* spores. The average diameter of the spread of this mycelium was only 9 cm., so that the frequently formed and rapidly growing mycelia propagated through the snow are probably distinct.

RENNERFELT (E.). **Das Wachstum einiger Fäulnispilze auf Holzschliff.** [The growth of some rot fungi on mechanical pulp.]—*Svensk bot. Tidskr.*, xxxvi, 2–3, pp. 301–311, 4 figs., 1942.

Twenty wood-rotting fungi were examined for their capacity to disorganize sterilized mechanical pulp, pieces of which, measuring 7 by 1 cm. and 600 to 700 mg. in weight, were placed in Kolle flasks containing malt agar cultures of the various organisms and maintained at a temperature of 22° C. for two months. The heaviest loss of weight (25·4±1 per cent.) was caused by a strain of *Polyporus* [*Polystictus*] *versicolor* from the Gothenburg (Sweden) Botanical Garden, closely followed by another collection of the same fungus from the Eberswalde (Germany) College of Forestry (24·4±3·3 per cent.), the affected material being entirely overgrown and of a yellow- to dark-brown colour. Appreciable reductions in weight were further caused by a number of others, including *Lenzites betulina* [ibid., xiv, p. 645] (Gothenburg), *Fomes annosus* (Centraalbureau voor Schimmelcultures), *Polyporus arcularius* [ibid., xvi, p. 358] (Gothenburg), Basidiomycete K. 65 (Robak), *P.* [*Polystictus*] *hirsutus* [ibid., xvii, pp. 88, 758] (Gothenburg), *Coniophora cerebella* [*C. puteana*] (Eberswalde), and *Corticium calceum* (Robak in *Nyt Mag. Naturv.*, lxxviii, p. 113, 1938), with percentages of 21·0±2·0, 18·6±1·1, 18·1±1·6, 16·8±2·0, 16·8±1·0, 16·0±2·2, and 15·3±0·4, respectively. When the fungi were situated at right angles to the piece of pulp, their rate of penetration was slower than when they were growing parallel with the specimen: on the other hand, in the latter position the pulp absorbed water from the substratum with such velocity as to retard the growth of the organisms, which cannot tolerate a moisture content exceeding 210 per cent. [ibid., xviii, p. 360].

Pulp from eight grinderies was inoculated with *P. versicolor*, which caused a significantly heavier loss in weight in the two lots subjected to hydraulic pressure (25·6±3·7 and 22·9±1·4 per cent.) than in the remaining batches treated by the kamyr process (12·0±3·9 to 21·3±0·6 per cent.).

**Copper treatment for wood.**—*Timberman*, xliii, 2, p. 34, 1941.

H. S. Andrews, of the Olympia (Washington) Wood Preserving Co., has developed a new method of timber (especially piling) impregnation involving immersion in an electrified copper solution which penetrates the fibres to a depth of 3 in. A reagent is used which hardens the wood on its transference to salt water and increases its tensile strength by up to 30 per cent. A pile treated by this process in 1926 was examined in October, 1941, and found to be in a perfect stage of preservation, with no evidence of dry rot [*Merulius lacrymans*], the sapwood being also unaffected by the elements, giving a probable added duration of life of four to ten years. It is estimated that the durability of piling treated by this method would be extended to upwards of 40 years and dry rot entirely eliminated from bridge and other heavy constructional timbers.

**Report of 31st annual inspection of C., B. & Q.R.R. experimental ties.**—*Wood Pres. News*, xix, 1, pp. 1–5, 1941.

A tabulated account is given of the results of the 1940 inspection of the experimental sleepers laid on the tracks of the Chicago, Burlington and Quincy Railroad Company in 1909 and 1910, three lots of which impregnated with (1) coal tar creosote, full-cell process, 10 to 12 lb. per cu. ft.; (2) zinc chloride (Burnett) [*R.A.M.*, xvii, p. 2] ½ lb. per cu. ft.; (3) a mixture of the two foregoing (Card process) [ibid., xiv, p. 545], with an absorption of ½ lb. zinc chloride and 3 lb. creosote per cu. ft.; while one (4) was left untreated. The average percentages of 20 different species of hard and softwoods removed on account of decay among the four lots (lines east) were (1) 26, (2) 35, (3) 55, and (4) 90, respectively, and the actual average years of service to date (1) 28·5, (2) 19·1), (3) 16·1, and (4) 5·4, respectively, the corresponding figures for lines west being (1) 17, (2) 35, (3) 49, and (4) 91 per cent., respectively, and (1) 29·5, (2) 17·9, (3) 15, and (4) 5·8 years of service, respectively.

**Report of Committee 4—Preservatives.**—*Proc. Amer. Wood Pres. Ass.*, xxxvii, pp. 32–44, 1941.

In the section of this report dealing with the composition and use of timber preservatives it is stated that before 1932 the composition of Wolman salts (triolith) most generally used in the United States was 85 per cent. sodium fluoride, 5 per cent. potassium dichromate, and 10 per cent. dinitrophenol. The present compositions are: triolith, 55 per cent. sodium fluoride, 35 per cent. sodium chromate, and 10 per cent. dinitrophenol; and tanalith, 25 per cent. sodium fluoride, 25 per cent. disodium hydrogen arsenate, 37½ per cent. sodium chromate, and 12½ per cent. dinitrophenol.

Before 1931 the composition of zinc-meta-arsenite was 76 parts of zinc oxide, 198 parts of arsenic trioxide, and 155 parts of acetic acid; the present formula is 80, 120, and 140 parts of these ingredients, respectively.

These Proceedings also include, among numerous others, reports on the painting of creosoted wood, the pressure treatment of oak railway sleepers and lumber, of Douglas fir [*Pseudotsuga taxifolia*], of southern pine [*Pinus* spp.] sleepers and lumber, and of poles, on treated wood for car lumber, on the biological environment in treated wood in relation to service life, on preservatives in Mississippi fence posts, and on the quantity of wood treated and the preservatives used in the United States in 1940.

Buschlen (M. J.). **The control of Cercospora leaf spot.**—*Sugar*, xxxvii, 2, pp. 40–41, 43, 1 fig., 1942.

The first large-scale tests of dusting and spraying for the control of sugar beet leaf spot or blight (*Cercospora*) [*beticola*] in Ohio were undertaken in 1938, a season of severe infection, at the instigation of H. C. Young [*R.A.M.*, xxi, p. 178]. The results then secured indicated a potential yield increase of 1½ to 3 tons per acre, with a corresponding rise of 1 to 1·5 per cent. in the sugar content. The outcome of the 1939 trials in Ohio and Michigan (J. H. Muncie) pointed to yield increases of 1½ to 6 tons per acre and an average rise of 1·5 per cent. in the sugar content. Even in the comparatively dry season of 1940, which did not favour the pathogen, the general opinion was that the fungicidal programme paid in most of the beet-growing areas of Ohio. Several substitutes are now available for the original copper-lime dust, which presented various disadvantages, notably the need for application to damp foliage, i.e., usually at night, two in general use being tribasic copper sulphate and basic copper chloride (fixed), containing 50 to 55 per cent. metallic copper, made up in the proportion of 13 parts with 12 of bentonite or flour and 75 of talc and used at the rate of 35 to 40 lb. per acre at 10- to 14-day intervals. Spraying with Bordeaux mixture (3–6–100) is equally effective with dusting, but somewhat more costly owing to the time factor and inaccessibility of water on most farms; the rate of application should range from 90 to 100 gals. per acre.

Leach (L. D.). **Multiple Beets more susceptible to rot than singles.**—*Sug. Beet Bull.*, vi, 3, p. 16, 1 fig., 1942.

Thinning sugar beets in such a way as to produce a uniform stand of single plants has been found to be an important factor in the control of the southern sclerotial root rot fungus (*Sclerotium rolfsii*) in California [*R.A.M.*, xx, p. 618], the average percentages of infection in seven commercial fields in three counties of the Sacramento Valley being 8·7 and 26·4 for single- and multiple-plant stands, respectively, while in some fields the incidence of the pathogen in the latter was 2·4 to 4·2 times as high as in the former.

Jensen (J. H.) & Goss (R. W.). **Physiological resistance to halo blight in Beans.**—*Phytopathology*, xxxii, 3, pp. 246–253, 3 figs., 1942.

In inoculation tests at the Nebraska Agricultural Experiment Station with *Phytomonas* [*Pseudomonas*] *medicaginis* var. *phaseolicola* on the leaves, pods, stems, and

germinated seed [*R.A.M.*, xii, p. 742] of four bean [*Phaseolus vulgaris*] varieties, only small, inconspicuous, necrotic lesions developed on the foliage of Red Mexican and Schwert 27 (Hamburg Market) [cf. ibid., xv, p. 697] in contrast to the large, chlorotic areas formed on the susceptible Red Kidney and Bountiful [cf. ibid., xix, pp. 450, 451], suggesting the possession by the two former of physiological resistance. The aberrant symptoms were produced on resistant plants of all ages and over a wide temperature range (16°, 22°, and 28° C.). Pod inoculations induced on the two resistant varieties small, rust-coloured necrotic lesions instead of the common water-soaked type. The stem puncture and germinated seed methods of inoculation failed to bring about systemic infection. Tests (not described in detail) on other varieties resulted in the development on Schwert Nordstern of lesions similar to those on Red Mexican and Schwert, using all four methods of inoculation. Great Northern, Princess of Artois, Robust, Kaiser Wilhelm, and Marktsieger were likewise resistant to germinated seed and stem inoculations but reacted variably to those on the leaves and pods; White Seeded Runner and Zucker Brech were susceptible to seed infection only, Startler was resistant except to pod inoculations, which gave variable results, while Blue Lake was resistant to stem and pod inoculations and varied in its response to those on the foliage. In other trials with leaf and pod inoculations only, California Pink and Blue Pod were resistant, and Drouth Resistant and Arikara Yellow contracted no infection.

These data are regarded as indicative of the presence of true physiological resistance in the Red Mexican and Schwert No. 27 varieties and others reacting similarly to halo blight.

ZAUMEYER (W. J.). **Inheritance of a leaf variegation in Beans.**—*J. agric. Res.*, lxiv, 2, pp. 119–127, 1 fig., 1942.

A heritable foliar variegation in hybrid beans (*Phaseolus vulgaris*) having Corbett Refugee as one of the parents has been encountered in studies at the United States Horticultural Station, Beltsville, Maryland [*R.A.M.*, xviii, p. 7]. This variegation is considered to be identical with the 'one-sided mosaic' of Horsfall *et al.* (*Plant Dis. Reptr*, xxi, p. 318, 1937) but distinct from that described by Reinking and Withiam (*Canner*, xc, p. 12, 1940). The data for its inheritance support a two-factor Mendelian hypothesis.

On the primary leaves the colour changes induced by the abnormality may range from a slight chlorotic streaking or mottling to a virtual absence of the normal green pigmentation, accompanied by reduction in size. Such leaves usually die. The trifoliate leaves are commonly sectored, with only small yellow areas on a normal green background, the variegation being often confined to one side of the leaflet, which almost or quite ceases to grow, resulting in curling and distortion. A necrotic streaking or spotting may develop on the petioles and affected parts of the leaflets. Rosetting and considerable stunting, with shortened internodes and adventitious bud production in the leaf axils, are prevalent in seriously diseased plants, which at best bear only a few twisted, curled, and shrunken, discoloured pods, whereas a normal seed crop may be obtained from those less severely attacked. The foliar variegation under discussion has also been observed in a small number of Wisconsin Refugee and Idaho Refugee beans grown in Colorado and Idaho.

A second similar but heritably distinct variegation has been observed affecting the trifoliate leaves only.

MÜLLER (A. S.). **Enfermedades de las Caraotas, Frijoles y Habas en Venezuela.** [Diseases of Beans, Cowpeas, and Lima Beans in Venezuela.]—*Agricultor venez.*, vi, 65–66, pp. 18–22, 4 figs., 1941.

The symptoms, etiology, and mode of dissemination, of the following diseases affecting beans (*Phaseolus vulgaris*) in Venezuela are described and measures for their

control recommended: rust (*Uromyces appendiculatus*), to which Red Kidney is resistant, mildew (*Erysiphe polygoni*), *Sclerotium rolfsii*, *Rhizoctonia* [*Corticium*] *solani*, mosaic (Red Kidney and Dwarf White Navy resistant), anthracnose (*Colletotrichum lindemuthianum*: Red Kidney and Tuerbarao resistant), *Ascochyta pisi*, *Cercospora canescens* [*R.A.M.*, xvi, p. 492], *C. columnare* [ibid., xv, p. 60], and *R.* [*Corticium*] *microsclerotia* [ibid., xix, pp. 3, 294], the two last-named also on *P. lunatus*. Cowpeas are attacked by *C. cruenta* [ibid., xvi, p. 492; viii, p. 505].

WORMALD (H.). **Black rot of Carrots.**—*Gdnrs' Chron.*, Ser. 3, cxi, 2887, p. 172, 1 fig., 1942.

Stored carrots submitted for inspection to the East Malling Research Station were found to be affected by a black rot caused by an *Alternaria* agreeing with the description of *A. radicina* given by Meier *et al.* in New York State [*R.A.M.*, ii, p. 5]. The conidial dimensions varied with the number of septa, e.g., 15 to 21 by 9 to 12 $\mu$ with one septum, 18 to 25 by 10 to 15 $\mu$ with two, 27 to 36 by 12 to 16 $\mu$ with three, and 33 to 42 by 11 to 12 $\mu$ with four; conidia with four or five transverse septa and one to five longitudinal walls measured 38 to 51 by 14 to 27 $\mu$, while one spore with five transverse septa but no longitudinal walls was 33 by 14 $\mu$. Sunken, dark areas, 1 to 2 cm. in diameter, bearing chains of spores, developed in a fortnight on carrots inoculated in the laboratory. The fungus, of which this appears to be the first authentic published record in England, though its occurrence was suspected by Salmon and Ware in 1934 [ibid., xiii, p. 354] and confirmed by the latter in 1938, grew well on prune agar. Diseased roots should be sorted out before storage and burnt, not thrown on the compost heap, where they might act as soil contaminants, endangering the next year's crop.

ELMER (O. H.). **The use of spergon for Sweetpotato seed and sprout treatments.**—*Plant Dis. Reptr*, xxvi, 2, pp. 44–46, 1942. [Mimeographed.]

In preliminary tests in 1941 at the Kansas Agricultural Experiment Station a spergon [*R.A.M.*, xxi, p. 245] (Naugatuck Chemical Division, United States Rubber Company) dip gave satisfactory control of stem rot [*Fusarium oxysporum* f. 2 and *F. bulbigenum* var. *batatas*] of sweet potatoes, besides exerting a stimulatory effect on the seed. Thus, the number of Little Stem Jersey sprouts produced by spergon-treated seed (2 oz. per gal., momentary dip) in hot-beds was 1,735, compared with 1,109 for semesan bel (same rate) [ibid., xix, pp. 327, 388], 988 for mercuric chloride (1 in 1,000 for 10 minutes), and 1,305 for the controls. Sprout treatments, also consisting of a momentary dip, were made in two commercial fields with spergon (2 oz. per gal.) and semesan bel (1 oz. per 5 pts). One of the fields was heavily infested by the pathogens, the untreated controls (Nancy Hall) showing 55·3 per cent. stem rot as against only 7 and 10·9 for the spergon- and semesan bel-treated plots, respectively, while the corresponding yields were 198·3, 324·2, and 269·8 bush. per acre, respectively. In the second field (Little Stem Jersey) the yields from the control, spergon- and semesan bel-treated plots amounted to 419·1, 519·2, and 465·6 bush. per acre, respectively.

JOHNSON (H. W.) & LEFEBVRE (C. L.). **Downy mildew on Soybean seeds.**—*Plant Dis. Reptr*, xxvi, 2, pp. 49–50, 1942. [Mimeographed.]

The examination, at the Division of Forage Crops and Diseases of the (United States) Bureau of Plant Industry, of diseased Mammoth yellow soy-bean seed of the 1941 crop disclosed a solid mass of globose, hyaline oospores, 23 to 32 $\mu$ in diameter, with smooth walls 3 $\mu$ in thickness, the epispore on staining with cotton blue in lactophenol sometimes showing irregular reticulations, which increased the diameter measurements given above by 3 to 9 $\mu$. Macroscopically the seeds appeared to be covered with a milky-whitish crust, and the coats were wrinkled and cracked. The

causal organism is believed to be identical with *Peronospora manshurica* [*R.A.M.*, xvi, p. 585; xix, p. 192], previously regarded exclusively as a foliar disorder in the United States, though reported to be seed-transmissible. It would appear from these observations, however, that the downy mildew, at any rate in certain seasons, may assume economic importance as an agent of damage to the seed crop.

LINN (M. B.). **Leaf-spot disease of cultivated Salsify.**—*Phytopathology*, xxxii, 2, pp. 150–157, 2 figs., 1942.

*Stemphylium botryosum* Wallr. [*R.A.M.*, xviii, p. 141] var. *tragopogoni*[*s*] n. var. is the name applied to a fungus responsible for foliar spotting, chlorosis, and withering of salsify (*Tragopogon porrifolius*) in small-scale commercial plantings of less than two acres on Staten Island, New York, where the annual loss from this source is estimated at 5 per cent. The fungus causes the formation of light brown lesions on the tips of the older leaves, followed by minute, light brown, necrotic spots surrounded by light green areas on the leaf blade. These lesions enlarge to 3 to 4 mm. in diameter and become cinnamon-brown with ashen-grey centres. Severely affected leaves turn yellow and wither. Though the symptoms induced by the fungus under observation somewhat resemble those due to *Sporodesmium scorzonerae*, the two pathogens are entirely different in other respects. The new variety is distinguished from *Stemphylium botryosum* proper only by its longer conidia (17 to 56 by 8 to 26 as compared with 24 to 39 by 19 to 31 $\mu$), which are ovoid-oblong to subangular, light brown, minutely verrucose, with one or more longitudinal and up to three transverse septa and are borne on fasciculate, occasionally branched conidiophores of the same colour, 25 to 180 by 4 to 5 $\mu$. Good growth was made on potato dextrose agar at an optimum temperature range between 21° and 27° C. Under appropriate conditions of temperature and high humidity, salsify plants inoculated with spore suspensions of the fungus developed lesions within 48 to 60 hours. The epidemic occurrence of the disease is attributed largely to soil-borne inoculum furnished by old, infected leaves from the previous crop, experimental evidence having indicated that the risk of transmission of the fungus by commercial seed is negligible. Satisfactory control of the leaf spot may be obtained by bi-weekly applications of Bordeaux mixture 4–4–50 or cuprocide 54 ($1\frac{3}{4}$ lb. per 50 gals. water), plus a suitable spreader, such as pyrolene M.P. (Standard Agricultural Chemicals) or Ultrawet (Atlantic Refining Co.), beginning during the first week in July and continuing until a week before harvest in early October.

KEN KNIGHT (G.). **Peanut diseases in certain Texas counties in 1941, with notes on occurrence of Peanut rust.**—*Plant Dis. Reptr*, xxv, 23, pp. 587–588, 1941. [Mimeographed.]

In 1941 excessive rainfall during the spring caused much damage to groundnuts in southern Texas. A seedling blight, apparently caused by a species of *Fusarium*, produced rotting of the tap roots. Leaf spot, due primarily, if not wholly, to *Cercospora personata* [*R.A.M.*, xxi, p. 65] caused slight to moderate defoliation in 5 of 37 fields surveyed. Southern blight (*Sclerotium rolfsii*) [ibid., xix, p. 579] was noted in 11 of 19 fields in Wilson County, causing losses of yield ranging from under 1 to 12 per cent. In Atascosa County one of three infected fields showed 25 per cent. loss of yield. In Frio County it had clearly caused serious loss in one partly harvested field. In an experimental field in Wilson County it reduced the yield by at least 50 per cent. In contrast to what was observed in 1940 death of immature plants as a result of infection was common, reaching 10 per cent. in some rows, and sclerotia were abundantly present on the roots and pods of affected plants both in the experimental field and in all other fields where the disease was found. In a $\frac{1}{8}$ acre garden plot of Jumbo-Runner groundnuts some 10 per cent. of the plants had been killed off by *S. rolfsii* when observed on 3rd November.

Rust (*Puccinia arachidis*) [ibid., xix, p. 261] appeared on several selections in an experimental field in Wilson County early in October. On 28th October the disease was present in all of seven fields of Spanish groundnuts in Frio County, but was causing appreciable damage in only one, in which the leaves had a scorched appearance. These appear to be the first records of groundnut rust in Texas.

WELCH (A.) & MELHUS (I. E.). **Wilt resistance in $F_1$ hybrid Watermelons.**—*Phytopathology*, xxxii, 2, pp. 181–182, 1942.

In 1937 at the Iowa Agricultural Experiment Station a selection from the watermelon variety Dixie Queen susceptible to wilt (*Fusarium bulbigenum* var. *niveum*), inbred for three generations, was crossed with a wilt-resistant inbred selection from a three-way cross (Iowa Belle × Jugoslavia 7, back-crossed on Iowa Belle), with a view to the development of a round, striped, resistant watermelon. The $F_1$ progeny of this cross were 70 to 85 per cent. wilt-resistant [*R.A.M.*, xvi, pp. 14, 369, 439]. In September, 1940, 71·4 per cent. of the plants raised from the $F_1$ seed were alive, the remainder having been killed by the fungus. In another test the $F_1$ progeny of two out of twelve crosses, viz., Japan 7 × Thurmond Grey and Japan 7 × Dixie Queen, proved 80 per cent. wilt-resistant; the incidence of resistance in the other ten ranged from 50 per cent. to nil, the 35 susceptible Dixie Queen controls all being killed. The discrepancy between these results and those of Orton (*Proc. Soc. hort. Sci.*, p. 28, 1907) and of Porter and Melhus [*R.A.M.*, xi, p. 557], who found resistance to wilt to be a recessive character in the $F_1$, may be attributable to the use in earlier breeding experiments of citron melons as the resistant parents instead of watermelons as at present.

THOMAS (K. M.). **Detailed Administration Report of the Government Mycologist for the year 1940–41.**—*Rep. Dep. Agric. Madras, 1940–41*, pp. 53–74, 1941.

All the 77 rice selections tested at the Central Farm, Coimbatore, for their reaction to blast (*Piricularia oryzae*) [*R.A.M.*, xx, p. 148] proved to be more or less susceptible, the percentage of infection ranging from 19·1 in No. 4055 to 80·6 in No. 4012. Two new selections, 11348 and 10998, which showed only 0·8 and 1·9 per cent. infection, respectively, last year, contracted 38·1 and 42·8 per cent., respectively, during the period under review. The results of experiments to determine the influence of the sowing date on the incidence of blast in ten varieties showed the heaviest infection to occur in the September plantings, with a gradual decline through October to November (when a minimum of 0·2 per cent. was registered for Co. 4 and Adt. 6) for seven of the selections tested.

Experiments were conducted to ascertain the influence of infected seed and soil, severally or combined, on the development of *Helminthosporium oryzae* [*Ophiobolus miyabeanus*] in rice seedlings, with the following results. Infected seeds gave rise to 24·6 and 22·3 per cent. disease in sterilized sand and soil, respectively; infected seeds in infected sand and soil to 40·3 and 29·8 per cent., respectively; and healthy seeds in infected sand and soil to 31·9 and 26·1 per cent., respectively, the incidence of the pathogen in the control plots (soil only) being 5·2 per cent. It is apparent from these data that both seed and soil can serve as sources of infection. When artificially infected seeds were sown in sand and kept for a fortnight at three different temperatures, no germination occurred at 10° C., while at 15° the percentages of diseased seedlings and mortality were 60 and 46, respectively, and at 28° to 29° 38·6 and 12, respectively, from which it is evident that the blight would assume a very severe character in cold weather. *O. miyabeanus* was experimentally shown to be pathogenic to rice at all stages of development from seedling to ear head and to attack all organs, e.g., leaves, leaf axils, and ears, indiscriminately. Both strains of the fungus used were capable of attacking the foliage of tenai [*Setaria italica*], cumbu [*Pennisetum typhoides*], and sugar-cane. Ten minutes' immersion of the diseased seed in water

heated to 55° reduced the incidence of infection in the Mtu 7, 8, and 9 selections from 100 to 20, 92 to 24, and 88 to 20 per cent., respectively.

None of the 15 ragi [*Eleusine coracana*] selections tested for their reaction to blast (*Piricularia* sp.) was resistant, but E.C. 155 was relatively free from infection, contracting only 24 and 28 [24 and 29 in the table] per cent. in the July- and August-sown crops, respectively, compared with up to 89 per cent. in E.C. 1507. The period of severe infection from the end of October to mid-December coincided with a high degree of atmospheric humidity (79 to 92 per cent.) and a rainfall of 17·4 in. between the times of flowering and harvest. The drier conditions prevailing during the ripening of the October-sown crop, harvested in the first 12 days of February, led to a decrease in infection (6 to 31 per cent.), while the crops sown from January to June and in November and December were free from disease. Heavy seedling infection does not necessarily connote a high incidence of blast in the transplanted crop, which may, in fact, be remarkably healthy. Seedlings were shown by inoculation experiments to be more susceptible than older plants, while tests on discoloured seeds of E.C. 593 revealed the presence of the pathogen on the surface in 5 to 42 per cent. of those that failed to germinate. In cross-inoculation experiments with *Piricularia* spp. *P. oryzae* from rice and the species from *Panicum repens* were pathogenic only to their own hosts, *Piricularia* sp. from *E. coracana* attacked its own host and wounded leaves of *S. italica*, while conversely *P. setariae* from the latter infected *E. coracana*: neither *P.* sp. from *E. coracana* nor *P. setariae* was pathogenic to rice or *Panicum repens*.

Only two of the 54 red gram [*Cicer arietinum*] varieties tested for their reaction to wilt (*Fusarium vasinfectum*) showed any appreciable degree of resistance, namely, Pusa 80 and Bulsar White (0 and 2·5 per cent. infection, respectively, as against 51·2 to 100 in the remainder).

The bunch-type groundnut A.H. 45 was the most resistant to wilt (*Macrophomina phaseoli*) of the 20 varieties tested, with 9·2 per cent. infection compared with up to 29·4 and 44·1 in the other bunch and spreading selections, respectively. March- and April-sown crops of the susceptible Mozambique A.H. 42 contracted heavy infection (38·9 and 35·8 per cent., respectively), compared with only 4 per cent. in the May-planted.

In trials on the effect of the mode of inoculation on the amount of red rot (*Colletotrichum falcatum*) developing in sugar-cane, introduction through bore holes in the setts resulted in the maximum percentages of 89, 87, and 27 per cent. in Co. 419, Poovan, and Co. 281, respectively, followed by inoculation of the cut ends with a culture of the fungus (76 and 22 per cent. in Co. 419 and Co. 281, respectively), and mixing fragments of diseased cane with the soil (16 per cent. in Co. 413), no infection being produced by smearing the culture on the root bands.

As in previous years the Co. 205 (Pusa), 422, 434, 508, 511 and Uba (S.H. 38) sugar-cane varieties continued to show resistance to mosaic, which was further absent from Co. 411, 432, and Uba (S.H. 281), formerly slightly susceptible.

In connexion with a study of cotton seedling blight and boll rot a comparison was made between the causal organism, *C. indicum* [ibid., xix, p. 259; xx, p. 149], *C. curcumae* [ibid., xi, p. 545], *C. capsici* [ibid., xx, p. 317], and *C.* spp. from local cotton, *Aristolochia*, and Bengal gram, the results of which showed all the different isolates to be merely strains of a single species, for which the earliest name is *C. capsici*.

The treatment of Cambodia cotton seed with 1 per cent. formalin, ceresan, or agrosan G did not impair germination for immediate or delayed sowing (up to 45 days), and eliminated all trace of primary infection by angular leaf spot (*Phytomonas* [*Xanthomonas*] *malvacearum*) which developed in the controls.

Orange trees sprayed against leaf and fruit fall (*Phytophthora* sp.) [ibid., xx, p. 149] with 1 per cent. Bordeaux mixture in the pre-monsoon or monsoon periods or in both showed 32·02, 19·96, and 6·22 per cent. fruit fall per tree compared with 71·94 per

cent. in the control. In another test with 0·5 per cent. oil-Bordeaux mixture, the pre-monsoon, monsoon, and both applications were equally effective against leaf fall, while fruit fall was again better controlled by two treatments than by one, and by the monsoon than by the earlier spray, the percentages of infection per tree in the pre-monsoon, monsoon, two-spray, and control plots being 38·2, 28·6, 24, and 47, respectively.

Acid limes and rough lemons have shown immunity from the forms of gummosis and root rot affecting Vadlapudi oranges (*Citrus maderaspatna* Tanaka) in the Bezwada district, and it is hoped to utilize this character in the development of permanent methods of control of a serious disease.

Storage rot (*Pythium* sp.) of ginger rhizomes [ibid., xx, p. 150] was effectively combated by immersion for 1½ hours in 0·1 per cent. mercuric chloride or for 30 minutes in 0·25 per cent. agrosan G.

**Plant diseases. Notes contributed by the Biological Branch.**—*Agric. Gaz. N.S.W.*, liii, 2, pp. 91–94, 4 figs., 1942.

The spike-harrow system of steam sterilization is stated to be gaining in favour among growers of glasshouse tomatoes in the Sydney metropolitan area, though the inverted pan method is still widely used elsewhere in New South Wales. A pair of steam harrows costs about £24, as against £14 for a pair of pans, but the former will treat a standard house (96 by 15 ft.) in about 10 hours (with a Sentinel boiler), while 16 hours are required for the latter. Also, two men can operate the steam harrow system, while three are required for the pan.

Effective control of passion fruit [*Passiflora edulis*] brown spot (*Alternaria passiflorae*) [*R.A.M.*, xix, p. 420] is possible only when spraying is carried out in advance of the disease. The vines should be pruned at least once a year, and this operation should be followed by application of Bordeaux mixture (6–4–50) at monthly intervals in spring and summer and at intervals of two months during the cooler months. The spray must reach the inner portions of the vines.

Dowson (W. J.). **The generic name of the Gram positive bacterial plant pathogens.**—*Trans. Brit. mycol. Soc.*, xxv, 3, pp. 311–314, 1942.

The great majority of bacterial plant pathogens are Gram-negative [*R.A.M.*, xx, p. 197], but for the six well-authenticated Gram-positive species a genus other than those used for the accommodation of the Gram-negative forms must be sought. The species in question have all been referred by Bergey [ibid., xix, p. 203] to *Phytomonas* as *P. fascians* Tilford, *P. flaccumfaciens* (Hedges) Bergey, *P. insidiosa* (McCulloch) Bergey, *P. michiganensis* (Erw. Smith) Bergey, *P. sepedonica* (Spieckermann) Magrou, and *P. rathayi* (Erw. Smith) Bergey. However, since the genus *Phytomonas* comprises both Gram-negative, motile and Gram-positive non-motile forms, it is unacceptable to most bacteriologists, besides having been proved invalid by Miss Elliott [ibid., xvii, p. 302] and the author [ibid., xviii, p. 658].

In this connexion reference is made to the genus *Corynebacterium* Lehmann & Neumann, which was studied by H. L. Jensen (*Corynebacteria* as an important group of soil micro-organisms.—*Proc. Linn. Soc., N.S.W.*, lviii, pp. 181–185, 1933; lix, pp. 19–60, 1934). They are described in Bergey (p. 791) as non-motile, without endospore formation, Gram-positive, non-acid-fast, normally rod-shaped but with a strong tendency to the development of irregular, club- or wedge-shaped, sometimes branching cells, multiplying by a characteristic 'snapping' division, which causes the bacteria in microscopic preparations to appear in V- or III-like patterns or irregular groups comparable to Chinese letters. Among the species found to be abundant in certain grass soils of New South Wales were two closely resembling, and subsequently found to be identical with, *P. insidiosa* and *P. michiganensis*, for which Jensen recommended the names *Corynebacterium insidiosum* and *C. michiganense*, respectively. It is further

apparent from the investigations of Tilford [*R.A.M.*, xvi, p. 102] and Miss Lacey [ibid., xviii, p. 597] that *P. fascians* also agrees in its erratic mode of development and other features with *Corynebacterium*.

Taking these data into consideration, the writer advocates the following nomenclature for the six phytopathogenic bacteria under discussion: (1) *Corynebacterium sepedonicum* (Spieckermann) n.comb., the agent of potato ring rot; (2) *C. rathayi* (Smith) n.comb., causing yellow slime disease of cock's foot grass [*Dactylis glomerata*]; (3) *C. michiganense* (Smith) Jensen, responsible for Grand Rapids disease or bacterial canker of tomato; (4) *C. insidiosum* (McCulloch) Jensen, the agent of lucerne bacterial wilt; (5) *C. flaccumfaciens* (Hedges) n.comb., causing a systemic bean (*Phaseolus*) disease; and (6) *C. fascians* (Tilf.) n.comb., the causal organism of sweet pea and strawberry fasciation and of leafy galls on various ornamentals. Of these, only Nos. (2) and (6) have been recorded for Britain.

Jamieson (M. C.). **Requisites for the recognition of the blue-green Pseudomonas.**—*Sci. Agric.*, xxii, 7, pp. 401–409, 1942.

This is a study of two generic characters of the genus *Pseudomonas*: pigment production and fluorescence. Pigment production was found to require sulphate, phosphate, and magnesium. These were present in nutrient media prepared in tap water, which favoured pigmentation, while the same media made with distilled water were found unsuitable. Pigmentation was less pronounced on the nutrient agar slants than in the liquid media. The most suitable media for routine tests and research purposes were modified Sullivan's 'K' medium and a combination of this with nutrient milk agar.

For the demonstration of fluorescence in cultures a 400-watt Mazda ultra-violet lamp was used. Under this light the cultures on media prepared with tap water were bright and of yellow, green, greenish blue, blue, and dark blue colours, while all those on media made with distilled water and also cultures of *Achromobacter* on all media were of a dull blue fluorescence. Cultures of *Pseudomonas* streaked on agar slants and colonies from pure culture platings displayed fluorescence under ultra-violet light many days before they showed pigmentation in daylight. The ultra-violet technique is, therefore, recommended as a more accurate and rapid method than any based on the observation of pigment. Recognition on subsurface colonies by the ultra-violet method is rendered possible by puncturing the agar above such colonies with a sterile needle and thereby allowing the access of air for part of the incubation period. In the modified synthetic medium 'K' the differences in colours of fluorescence are stated to be so marked as to suggest the possibility of differentiating species and strains of *Pseudomonas* by this means. Further research is, however, required for the determination of the various fluorescent colours. It is noted that there appears to be a direct correlation between the fluorescent colours of the pigments and the $P_H$ produced by various cultures.

Mallmann (W. L.), Botwright (W. E.), & Churchill (E. S.). **The selective bacteriostatic effect of slow oxidizing agents.**—*J. infect. Dis.*, lxix, 3, pp. 215–219, 1941.

The slow oxidizing agents, potassium dichromate and sodium azide, were experimentally shown to exert a bacteriostatic action in appropriate dilutions, e.g., 1 in 10,000, on Gram-negative bacteria in nutrient media, while permitting the growth of Gram-positive organisms, especially *Staphylococcus* spp.

Lightle (P. C.), Standring (Elizabeth T.), & Brown (J. G.). **A bacterial necrosis of the Giant Cactus.**—*Phytopathology*, xxxii, 4, pp. 303–313, 5 figs., 1942.

*Erwinia carnegieana* Standring n.sp. is the name proposed for the bacterium implicated in the widespread and destructive necrosis of the giant cactus (*Carnegiea*

*gigantea*) in southern Arizona [*R.A.M.*, xx, p. 394]. The organism is a greyish-white, actively motile, peritrichiate, Gram-positive, non-sporulating rod, 1·6 to 2·9 by 1·1 to 1·8 $\mu$, liquefying gelatine very slowly at 20° C., reducing nitrates, not coagulating milk, occurring singly or in pairs, producing on the surface of poured agar plates circular, slightly raised, smooth, greyish-white, wet-shining colonies with an entire, well-defined margin, and evolving acid and gas from arabinose, dextrose, galactose, levulose, maltose, sucrose, raffinose, mannitol, and salicin. The differences between *E. carnegieana* and two other bacterial pathogens of Cactaceae, viz., *Bacterium cactivorum* on *Cephalocereus senilis* in Italy [ibid., xiv, p. 765] and *Bacillus cacticidus* on *Opuntia* in South Australia [ibid., iii, p. 707], are tabulated and briefly discussed. Certain similarities between the new disease and soft rot due to *E. carotovora* suggested the possible identity of the two causal organisms, but their morphological and biochemical differences, as well as the failure of cross-inoculation experiments, excluded this interpretation.

Greaney (F. J.) & Machacek (J. E.). **Prevalence of seed-borne fungi on cereals in certain seed inspection districts of Canada.**—*Sci. Agric.*, xxii, 7, pp. 419–437, 1942.

Seed surveys and pathological tests made with a large number of samples of wheat, oat, barley, and rye seed-grain of the 1939 and 1940 crops from different districts of Canada showed that among the numerous organisms isolated species of *Alternaria* were the most common, though not harmful, and species of *Helminthosporium* and *Fusarium* were the most important pathogens. *H.* spp. (mainly *H. sativum* on wheat, barley, and rye, *H. teres* on barley, and *H. avenae* on oats) were much more prevalent than *F.* spp. on wheat and barley, while on oats *F.* spp. were found as frequently as *H. avenae.* In greenhouse tests high positive correlations were found between the percentage of seeds infected with *H. sativum* and *H. avenae* and the amount of disease subsequently developing in the seedlings. The surveys indicate that seed-grain infection in Canada varies widely from year to year, from province to province, and even from field to field. Thus, the total amount of wheat, oats, and barley seed-grain infection was greater in Manitoba in 1940 than it was in 1939; on the other hand, oats and barley seed-grain infection in the eastern provinces was greater in 1939 than it was in 1940. In 1939 the cleanest wheat seed-grain came from Saskatchewan, and rye seed-grain from Saskatchewan and British Columbia yielded no organisms in 61 and 71 per cent. of the kernels, respectively; samples of oats and barley seed-grain from Manitoba, Alberta, and British Columbia were relatively free from infection by *H.* and *F.* spp., while those from the Maritime Provinces, Quebec, and Ontario were severely attacked. In 1940, samples of oats and barley seed-grain from the Maritime Provinces were more severely infected with these fungi than were those from Manitoba. The great majority of the wheat samples tested in 1940 were virtually free from smut fungi, while oats and barley samples were carrying a heavy smut spore load, sufficiently dangerous to require seed treatment. Attention is consequently drawn to the necessity for seed treatment of oats and barley for the control of smut. In greenhouse tests, seed treatment of infected wheat, oats, and barley with an organic mercury dust almost completely controlled diseases caused by *H.* and *F.* spp. and improved germination of the infected seed, but it had little or no effect on the germination of clean seed if sown in clean soil. It is considered that the results of these studies have proved the practical value of annual seed-borne disease surveys and pathological seed-grain tests to seed-producers and grain-growers.

Vanterpool (T. C.) & Sprague (R. A.). **Pythium arrhenomanes on cereals and grasses in the northern Great Plains.**—*Phytopathology*, xxxii, 4, pp. 327–328, 1942.

Pure-culture isolations from cereals and grasses in North Dakota in 1940–1 revealed the prevalence of *Pythium arrhenomanes*, especially in the lighter soils of the central regions, the same fungus having also been collected on wheat, maize, and grasses in

Minnesota and South Dakota, and wheat in eastern Montana. *P. aristosporum* Vanterpool, occasionally isolated from wheat affected by browning root rot in Saskatchewan [*R.A.M.*, xix, p. 696], was obtained from barley and wheat in North Dakota and Montana, respectively. In 1941 the disease first appeared about 10th May and continued to develop for two months, though *P. arrhenomanes* was recovered from warm-temperature grasses, e.g., *Setaria italica,* until early August, and from wheat in the Red River Valley as late as 29th July. *P. de Baryanum* and several congeneric forms were isolated from grasses with damping-off in the early part of the season and later following rainy periods. Thatcher wheat seedlings grown at Saskatoon, Saskatchewan, and Mandan, North Dakota, contracted moderate to severe infection following inoculation with *P. arrhenomanes* from the following naturally diseased hosts: *Aegilops triuncialis, Agropyron amurense, A. caninum, A. ciliare, A. cristatum, A. dasystachyum, A. intermedium, A. pungens, A. repens, A. trachycaulum, Ammophila arenaria, Bouteloua curtipendula, B. gracilis, Brachypodium sylvaticum, Bromus carinatus, B. erectus, B. inermis, Echinochloa crus-galli, Elymus glaucus, E. interruptus, E. junceus, Festuca rubra* var. *commutata,* barley, *Panicum miliaceum,* rye, *S. italica, S. viridis, Stipa comata,* wheat, *Triticum dicoccum, T. durum,* and maize. The fungus was further isolated from *Agropyron desertorum, A. riparium, A. spicatum, A. trichophorum, Arrhenatherum elatius* [*A. avenaceum*], cultivated and wild oats, *Sorghastrum nutans,* sorghum, and Sudan grass, but the pathogenicity of cultures from these hosts remains to be tested.

Reed (G. M.). **Inheritance of smut resistance in hybrids of Navarro Oats.**—*Amer. J. Bot.*, xxix, 4, pp. 308–314, 1942.

In further studies on the inheritance of resistance to *Ustilago avenae* and *U. levis* [*U. kolleri*: *R.A.M.*, xx, p. 525; xxi, p. 251] in oats, the variety Navarro was found to be resistant to all the known races of both smuts tested. Crosses of Navarro with other varieties were made in 1936 and the data on the resistance to smut of the $F_2$ and $F_3$ generations of hybrids from these crosses, studied during the following five years, are presented as follows. The behaviour of hybrids from the cross Navarro × Hull-less indicated a two-factor relation for inheritance of resistance in the case of race 1 of *U. avenae* and a three-factor difference in that of races 1 and 7 of *U. kolleri*. The results obtained with race 12 of *U. avenae* were in striking contrast to those obtained with the previous races, indicating a very different basis for the inheritance of resistance: of a total of 121 $F_2$ plants inoculated with this race, 62 were infected; of a total of 225 $F_3$ plants, 26 were resistant, 86 segregating, and 113 susceptible.

The behaviour of hybrids from the cross Navarro × Black Mesdag indicated at least five independent factors for resistance to races 7 and 9 of *U. kolleri* and three factors to race 12 of *U. avenae*. The behaviour of hybrids from the cross Navarro × Gothland suggested the presence of two factors for resistance to race 1 of *U. avenae.*

All the four parental varieties used in these tests were resistant to race 10 of *U. avenae*; however, an occasional $F_3$ progeny of Navarro × Hull-less and Navarro × Gothland contained 1 to 13 infected plants. No infected plants were observed in the $F_3$ progenies of Navarro × Black Mesdag.

Koehler (B.). **Natural mode of entrance of fungi into Corn ears and some symptoms that indicate infection.**—*J. agric. Res.*, lxiv, 8, pp. 421–442, 1 pl., 7 figs., 1942.

In a study of maize ear rots conducted during 1933, 1935, and 1937, unsterilized natural tissues from maize ears (Reid Yellow Dent variety) in various stages of development and mature surface-sterilized whole and dissected kernels were plated on agar medium, and histological sections of kernels examined. *Fusarium moniliforme* [*Gibberella fujikuroi*: *R.A.M.*, xx, p. 57] was found to be the most prevalent organism in maize ears. In most cases infection by this fungus and *Cephalosporium acremonium* originated in the region of the silks, spreading thence to the kernels,

pedicels, vascular cylinder, and finally the shank. Only in very few cases did *G. fujikuroi* infection proceed in the opposite direction, from shank to kernel. *C. acremonium* also commonly infected the lower half of the kernel surface, progressing down the ear in the region where the glumes occur; in a few cases the fungus reached the kernels by way of the butt of the cob, vascular cylinder, and pedicels. Internal kernel infection by either fungus did not become established until the ears were approaching maturity.

Infection by *G. zeae* [*G. saubinetii*] nearly always started at the tip ends of the ears, spreading downwards most rapidly in the region of the silks. *Diplodia zeae* and *Nigrospora* spp. (*N. oryzae* and *N. sphaerica*) entered the ear either at the tip or rather more frequently at the butt end, the latter type being very largely the result of local infection on the shank. *D. zeae* caused a more active and more extensive rot behind the advancing mycelium than any of the other fungi. A species of *Monilia*, which was very prevalent in some seasons, appeared to enter the ears exclusively in the region of the silks, readily invading the pedicels and vascular cylinder and penetrating in some few cases through to the butt of cob. No internal kernel infection was found. Infections by several species of *Penicillium* occurred later in the season and were less prevalent than those by *G. fujikuroi*, but the mode of penetration was similar; internal kernel infection was, however, practically absent.

Infection by *G. fujikuroi* and to a lesser extent by *G. saubinetii*, was increased by earworm (*Heliothis armigera*) damage to the tip of the ear; that by *N.* spp. and *C. acremonium* was only very slightly increased, and that by *D. zeae* did not appear to be affected by this factor. Discoloration under the husk at the butt end of otherwise healthy-looking cobs was found to be strongly indicative of infection by *D. zeae*, *N.* spp. and *G. fujikuroi*, while infection by *C. acremonium*, *G. saubinetii*, and *Penicillium* spp. was little or not at all correlated with discoloration. *Nigrospora* infection was strongly related to shredded shanks. Internal kernel infection by all fungi studied was found to be most common in the tip cap, and, in a decreasing order of prevalence, in the tissues of the germ, the floury endosperm, and the horny endosperm. White streaks on the pericarp of kernels yielded *G. fujikuroi*, *C. acremonium*, and *N.* spp. The white colour is believed to be due to the disintegration of the cells which cease to be transparent and take on a chalky appearance.

CASS-SMITH (W. P.), OWEN (R. C.), & HARVEY (H. L.). **Water spot of Navel Oranges in relation to the application of white oil sprays and various other orchard practices.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xviii, 4, pp. 267–284, 4 figs., 1941.

During the past few years, in the upper south-west area of Western Australia, where 30 in. or more of rain (some 80 per cent. of the annual total) fall during ripening and harvesting, mature Navel oranges have been found to rot on the trees, mainly owing to attack by water spot. This trouble, not before recorded from Western Australia, closely resembles water spot in California [*R.A.M.*, xvii, p. 390; xx, p. 299]. Laboratory investigations showed that the disease is caused by imbibition of water by the rind, typical symptoms resulting when oranges were immersed in trays of water.

In field experiments in 1940 it was found that spraying 72 trees with white spray oil (1 : 40) much increased the incidence of water spot and citrus pit, and also rendered rinds more susceptible to slight injuries by rubbing against leaves and twigs, such injuries being known to favour water spot [ibid., xvii, p. 671]. On the average, losses in sprayed fruits were three times greater than in the unsprayed.

Losses due to water spot began earlier on the sprayed than on the unsprayed fruits. Thus, avoiding white oil sprays may give a longer disease-free picking period, but liability to the condition increases with maturity, so that if heavy rain falls in late July and August considerable loss from water spot may result even on non-oiled trees.

Field studies indicate that a correlation exists between the continued application

of heavy fertilizer dressings rich in readily available nitrogen and the incidence of the disease. The practice of growing leguminous cover crops during winter is, however, a cheap and effective aid to the maintenance of both soil nitrogen and humus content, and deserves encouragement.

When clean oiled and non-oiled oranges were loosely packed in sterilized cases and stored for 11 weeks, the oiled fruits showed 11 per cent. loss by moulds (*Penicillium* spp.) as against only 4·2 per cent. for the non-oiled.

In a further experiment oranges from trees not receiving the oil spray were placed in shed storage after being treated with a 2 per cent. concentration of wax emulsion, with the same material plus one per cent. concentration of shirlan AG, and with one per cent. shirlan AG only, with untreated controls, half the oranges in each case being wrapped in sulphite paper wraps. In all treatments the fruit kept for 16 weeks without excessive loss from [unspecified] moulds or storage spot, but when held three weeks longer rapid deterioration set in. The paper wraps were not very effective in preventing spread of infection, and apparently it would be better and cheaper to remove affected fruits at frequent intervals.

Schiel (E.). **La lucha contra Sphaceloma australis, parásito del Mandarino en la Provincia de Santa Fe.** [The campaign against *Sphaceloma australis*, a parasite of the Tangerine in the province of Santa Fe.]—*Rev. argent. Agron.*, ix, 1, pp. 19–27, 1942. [English summary.]

A tabulated account is given of the author's experiments in 1938–9 and 1940–1 in the control of scab (*Sphaceloma* [*Elsinoe*] *australis*) on severely affected tangerines in the province of Santa Fe, Argentina, from which he concludes that commercially adequate results are obtainable by two applications of 1 per cent. Bordeaux mixture, the first to be given just before flowering and the second when at least three-quarters of the petals have fallen [*R.A.M.*, xvii, p. 170].

Rae (M. Viola). **A case of obscure pulmonary infection: observations on lung infection roentgenologically tuberculous but bacteriologically yielding a pathogenic yeast and non-pathogenic acid-fast bacillus.**—*Canad. publ. Hlth J.*, xxxiii, 1, p. 40, 1942.

A report from the Mountain Sanatorium, Hamilton, Ontario, illustrates the confusion arising from the presence of acid-fast saprophytes in sputum and gastric washings in a case roentgenologically [*R.A.M.*, xx, p. 61 *et passim*] suggesting pulmonary tuberculosis, but inducing no symptoms. Culture repeatedly yielded a chromogenic, acid-fast bacillus non-pathogenic to guinea-pigs and hens, while *Monilia* [*Candida*] *albicans* was also isolated from the sputum and gave positive results in experiments on rabbits, rats, and guinea-pigs. The fungus was concluded to be the responsible agent in the production of the pulmonary condition, with the acid-fast bacillus acting as a non-pathogenic contaminant.

Frank (T. J.). **Bronchopulmonary moniliasis.**—*Melbourne Hosp. clin. Rep.*, xii, 2, pp. 11–17, 1 pl., 1941.

A case of bronchopulmonary moniliasis, possibly of the primary type, in a 62-year-old woman is fully described and critically discussed under its clinical, diagnostic, and therapeutic aspects. *Monilia* [*Candida*] *albicans* developed in profusion in cultures from the sputum on Sabouraud's medium, and X-ray photographs [cf. preceding abstract] revealed widespread lung infiltration, especially involving the bases. Attention is drawn to the unsuspected prevalence of pulmonary moniliasis and its close simulation of tuberculosis.

MARTIN (D. S.). **The practical application of some immunologic principles to the diagnosis and treatment of certain fungus infections.**—*J. invest. Derm.*, iv, 6, pp. 471–481, 1941.

The immunological data obtained in a limited number of cases of deep-seated fungal infection are presented and correlated with the results of various therapeutic procedures. Nine out of 17 patients (53 per cent.) suffering from blastomycosis (*Blastomyces* [*Endomyces*] *dermatitidis*) reacted positively to complement fixation, 9 out of 16 (56 per cent.) to skin tests, and 14 out of 17 (82 per cent.) to one or other, or both, of these methods. The diagnosis of moniliasis is much more difficult to establish than that of blastomycosis because of the high incidence of *Candida albicans* in the sputum and intestinal tract of persons in normal health. A positive reaction to this organism, therefore, is significant only in a patient with pulmonary infection whose sputum discloses the constant presence of *C. albicans*.

BERNSTEIN (T. B.) & FEINBERG (S. M.). **Air-borne fungus spores. A five-year survey of daily mold spore content of Chicago air.**—*J. Allergy*, xiii, 3, pp. 231–241, 9 graphs, 1942.

During the five-year period (1935 to 1939) covered by the authors' observations, *Alternaria* and *Hormodendrum* spp. constituted 72 per cent. of all the fungi developing on potato dextrose agar plates exposed daily for 15 minutes outside an upper window at the Northwestern University Medical School, Chicago. A decided seasonal trend was apparent in both these groups: in general, the maximum spore concentration (80 per cent. in the case of *Alternaria*) occurred from June to November, while the period of activity of *Hormodendrum* commenced earlier (in April) and continued longer (through December). The other two predominant moulds (*Aspergillus* and *Penicillium*) showed no tendency to seasonal fluctuation [*R.A.M.*, xxi, p. 290].

JENSEN (H. L.). **Micro-organisms active in the dew-retting of Flax.**—*Aust. J. Sci.*, iv, 2, p. 59, 1941.

The micro-organisms responsible for the 'dew-retting' of flax, the cultivation of which has undergone a rapid expansion in Australia since the outbreak of war, have not been studied at all in that country and not to much extent elsewhere, and a preliminary investigation of this problem was conducted at the University of Sydney from March to May, 1941. Flax straw taken from the field in various stages of decomposition, or incubated in a moderately humid condition in the laboratory, was found to harbour an abundant flora of bacteria, yeasts, and filamentous fungi, of which the last-named proved to be the true agents of retting [*R.A.M.*, iii, p. 87], though some activity in this direction was also shown by the white and pink forms of *Torula*, not hitherto observed in this capacity. *Bacterium herbicola* and *Bacillus mesentericus*, the predominating bacteria, were found to be incapable of retting sterile flax straw, the water-soluble components of which apparently served as their main source of sustenance. As regards the fungi, in the laboratory *Mucor* sp. and *Cladosporium herbarum* were most abundant at low temperatures (8° to 10° C.), *Rhizopus nigricans*, *C. herbarum*, and *Alternaria* spp. in the middle range (24° to 30°), and *Aspergillus* spp. in a warm atmosphere (37°). The field straw yielded principally *Dematium* [*Pullularia*] *pullulans*, *C. herbarum*, and *Alternaria* spp. All these organisms were capable of more or less rapid retting of the straw, but those with dark mycelia produced a fibre of the same dark colour as the natural dew-retted flax, while some, notably species of *Alternaria* and *Stachybotrys*, caused speedy weakening and destruction of the fibre. Theoretically, the Mucoraceae and Aspergillaceae would be the most appropriate fungi for dew-retting operations, since they neither discolour the fibre nor reduce its tensile strength; unfortunately, however, their activities do not extend to the field. This is apparently the first record of *P. pullulans* as an agent of retting. In this connexion it may be of interest to note that the three actively

retting fungal genera are also prevalent among the sooty moulds of New South Wales [ibid., xiv, p. 60; xvi, p. 700].

Baker (K. F.) & Thomas (H. Earl). **The effect of temperature on symptom expression of a Rose mosaic.**—*Phytopathology*, xxxii, 4, pp. 321–326, 1942.

In tests under controlled conditions at the University of California, Berkeley, on two rose varieties, Peerless and Rome Glory, symptoms of mosaic [*R.A.M.*, xix, p. 409] were shown to be favoured by temperatures ranging from 15° to 25° C. but to be much reduced in severity below 15°. Both under the carefully regulated conditions of the experiments and in the variable atmosphere of a greenhouse the symptoms developed in an entirely erratic fashion, a given leaf adjacent to a diseased one sometimes contracting infection and in other cases remaining healthy, while even companion leaflets frequently responded dissimilarly. Commercial rose-growing is usually carried on in greenhouses with diurnal and nocturnal temperature ranges of 20° to 25° and 14·5° to 17°, respectively, under which conditions the recognition and removal of severely diseased plants should be quite practicable, though there is little fear of the spread of infection under glass. In the field the situation is not so clear, and it may well be advisable to select budwood for large-scale plantings from mosaic-free greenhouse material.

Jenkins (Anna E.). **Poinsettia scab caused by Sphaceloma.**—*Phytopathology*, xxxii, 4, pp. 336–337, 1942.

The species of *Sphaceloma* responsible for poinsettia (*Euphorbia pulcherrima*) scab in a nursery at Honolulu, Hawaii, where considerable damage was observed in November, 1939, appears from specimens submitted by E. A. Bessey to the writer in 1941 to be identical with that reported by Ruehle on the same host from Florida [*R.A.M.*, xxi, p. 142]. Simultaneously with the outbreak of the disease on poinsettia the same or a similar trouble was observed on *Pedilanthus* sp. in a private garden, but further material is necessary in this case to establish the identity of the causal organism.

Burton (G. W.) & Lefebvre (C. L.). **Potash deficiency symptoms in Napiergrass, Pennisetum purpureum.**—*J. Amer. Soc. Agron.*, xxxiv, 4, pp. 372–375, 2 figs., 1942.

Strains of Napier grass (*Pennisetum purpureum*) resistant to eye spot (*Helminthosporium sacchari*) [*R.A.M.*, xxi, p. 21] have done well at the Georgia Coastal Plain Experiment Station in respect of high yields and winter-hardiness, but they tend to suffer from potash deficiency, expressed by the formation of irregular, brown spots on the leaves, sometimes accompanied by 'firing' of the tips and margins. These symptoms are more acute and develop earlier in the very leafy strains than in those with sparser foliage. The depletion of potash giving rise to the pathological condition is tentatively attributed to the large amounts of the element consumed by the plant in its copious leaf production. A cure was effected by the application of potassium chloride to the soil at the rate of 200 lb. per acre. The heavy withdrawal of potash by the Napier grass resulted in severe spotting of an adjacent planting of velvet beans [*Mucuna deeringiana*], indicating exhaustion of the available supplies over a distance of 8 to 10 ft.

McKinney (H. H.), Fellows (H.), & Johnston (C. O.). **Mosaic of Bromus inermis.**—*Phytopathology*, xxxii, 4, p. 331, 1942.

A yellow mosaic was observed in the spring of 1941 on *Bromus inermis* at the Kansas Agricultural Experiment Station, whence the diseased plants were transferred to Arlington Farm, Virginia, for inoculation tests with the virus, which proved pathogenic to its own host, Harvest Queen wheat, and White Tartar oats. Dried diseased

tissues after 51 days' storage at summer room temperatures, contained sufficient active virus to induce mosaic in all 12 wheat plants inoculated. None of the seven wheat viruses previously enumerated by the first-named author (*Circ. U.S. Dep. Agric.*, 442, 22 pp., 1937) gave positive results on *B. inermis*, the virus of which is therefore assumed to be distinct.

STEPHENSON (R. B.). **Sterilization technique for grass seeds.**—*Plant Physiol.*, xvii, 2, pp. 324–325, 1942.

In experiments at the University of Illinois to determine the relative merits of various sterilization procedures for the disinfection of Kentucky bluegrass [*Poa pratensis*] seed without impairment of germinative capacity, the mercury-containing preparations, semesan, semesan bel, and ceresan dust, were lethal to the seed, and calcium hypochlorite [*R.A.M.*, xviii, pp. 115, 228] was inadequate as a cleanser, but very satisfactory results, both as regards germination and freedom from infection were obtained by a one-minute dip in 95 per cent. alcohol followed by two hours' immersion in 2 per cent. calcium hypochlorite or 30 minutes in a 10 per cent. solution of the same compound (filtered), the latter being the writer's routine method. Subsequent germination of the seeds should be carried out on 2 per cent. agar, which is preferable to moist filter paper both as a source of moisture and for the detection of contaminants.

BECK (A. B.). **A survey of the copper content of Western Australian pastures.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xviii, 4, pp. 285–300, 1 map, 1941.

Details are given of chemical analyses of the copper content of some 200 samples of pastures growing in different parts of Western Australia [cf. *R.A.M.*, xxi, p. 347]. Samples obtained from areas in which stock show symptoms of copper deficiency were found to contain under 3 p.p.m. of copper (dry basis), while samples from sound areas contained over 5 and usually 7 to 12 p.p.m.; values between 3 and 5 p.p.m. are regarded as marginal. It was ascertained that the copper content of a pasture falls as it approaches maturity; heavy grazing also brings about a heavy reduction in copper. There was some indication that chemical analysis of *Cryptostemma calendulaceum* does not always give a correct indication of the copper status of soils. Copper deficiency is widely prevalent in Western Australia, though in some parts it may be confined to small pockets of certain soil types. The lateritic Darling Ranges may possibly be deficient in copper.

MODLIBOWSKA (IRENA) & FIELD (C. P.). **Winter injury to fruit trees by frost in England, 1939–40.**—*J. Pomol.*, xix, 3, pp. 197–207, 2 pl., 1942.

Good results in the treatment of frost injury to fruit trees were obtained at East Malling by nailing down the cracked and loosened bark firmly to the wood by two rows of small-headed nails ( ⅝in., 20-gauge, gimp pins) on each side of the cracks, using a light hammer. Vaseline was applied to the cracks to prevent drying out. On some trees, the nails were driven through small squares of rubber to prevent the heads from sinking into the bark. Healing was more rapid and satisfactory in the nailed than in untreated trees.

KIDD (F.) & WEST (C.). **Refrigerated gas storage of fruit. V. Conference, Doyenné du Comice, and Williams' Bon Chrétien Pears.**—*J. Pomol.*, xix, 3, pp. 243–276, 4 pl., 1942.

A full account is given of investigations carried out at East Malling, Kent, from 1934 to 1940, on the reaction of stored Conference, Doyenné du Comice, and Williams' Bon Chrétien pears (home-grown) to the composition of the storage atmosphere. In these studies, different combinations of the three variables (1) carbon dioxide concentration, (2) oxygen concentration, and (3) temperature were tested.

When Conference pears were stored in air (within 24 hours of gathering) at temperatures ranging from 34° to 64·4° F., at all the temperatures tested except the lowest the fruit passed from the hard, green condition, through the firm-ripe, melting-ripe, and over-ripe stages to the stage of 'sleepiness' which begins at the core and spreads through the flesh. This condition is termed 'core breakdown' [cf. *R.A.M.*, xx, p. 412], and is accompanied by a fall in the rate of carbon dioxide production.

At 34° in air the pears softened very slowly and eventually showed signs of yellowing. Softening was not enough to render the pears eating-ripe, and the sweetening, when it occurred, was accompanied by an unpleasant aldehydic flavour. This condition was followed by browning and mealiness of the flesh after some six months' storage, here termed 'low temperature internal breakdown'. If the pears were removed from the low temperature (34°) not later than about 3½ months from date of picking, they ripened normally at all three ripening temperatures tested, viz., 64·5°, 53·6°, and 45·5°. If maintained at 34° for about a fortnight longer, they ripened normally at the two higher ripening temperatures, but not at 45·5°. After any further period of storage at 34°, the pears, though appearing firm and sound on removal, did not ripen normally at any temperature.

In the gas storage trials with Conference pears only a small amount of brown heart [ibid., xix, p. 284] was observed. It developed early in the storage life and tended to increase with the storage period. Apparently, higher storage temperatures, higher percentages of carbon dioxide, and lower concentrations of oxygen are all associated with increase in brown heart.

An experiment was conducted in which the storage life of Conference pears picked on 19th September, 1938, and immediately stored, was compared with that of others picked on the same day and kept for 4, 10, and 13½ days at 53·5° before being placed in storage. The storage conditions used were cold storage in air at 34° and gas storage at 34° (in 5 per cent. carbon dioxide, 2·5 per cent. oxygen, and 92·5 per cent. nitrogen). The results showed that the pears stored after more than four days' delay in air at 53·5° were a failure, owing to internal breakdown in the cold-stored fruit and brown heart in the gas-stored. This experiment shows that pears must be placed in store and that the appropriate conditions of temperature and atmosphere must be established before the beginning of the climacteric rise in respiratory activity.

When Comice pears were kept under different conditions of gas storage at 34° and 31·5° the higher temperature was found to be unsuitable owing to the amount of brown heart that developed. Taking, as an example, the storage atmosphere that gave the best results (10 per cent. carbon dioxide, 2·5 per cent. oxygen, and 87·5 per cent. nitrogen), after 180 days the pears showed 5 and 75 per cent. brown heart at 31·5° and 34°, respectively. The maximum storage life obtained in this atmosphere was five months, as compared with four months in synthetic air at the same temperature. Under most of the storage conditions tested a few fruits became affected by scald.

As brown heart was the limiting factor in these tests of the refrigerated gas storage of Comice pears, and all the atmospheres used contained at least 5 per cent. of carbon dioxide, Comice pears were submitted to further trials, using gas mixtures containing low concentrations of both oxygen and carbon dioxide. In these the longest storage life, about five months, was obtained in two atmospheres both of which contained 3 per cent. of carbon dioxide with 2·5 and 5 per cent., respectively, of oxygen. This storage life was the same as the longest obtained in the earlier tests in an atmosphere consisting of 10 per cent. of carbon dioxide, 2·5 per cent. of oxygen, and 87·5 per cent. of nitrogen. In air the fruit kept well for 3½ months, as compared with four months previously. In spite of the low concentrations of carbon dioxide used, some brown heart developed in gas storage late in the storage life. In addition, a diffused browning of the flesh immediately beneath the skin, but not externally visible, developed to a limited extent, especially in the atmosphere consisting of 5 per cent. carbon dioxide,

2·5 per cent. oxygen, and 92·5 per cent. nitrogen. Towards the end of the tests a few fruits showed typical scalding of the skin.

With Bon Chrétien a small amount of brown heart developed in atmospheres containing 10 per cent. carbon dioxide at storage temperatures of 34° and 37°.

In an appendix it is stated that in 1941–2 many Conference pears developed without seeds and with only a rudimentary core. This fruit, when fully developed, had an abnormally high respiratory activity both in the pre-climacteric and climacteric phases, and developed 33 per cent. brown heart in gas storage, even when the concentration of carbon dioxide used was that previously found to give the best results with this variety.

Trout (S. A.), Tindale (G. B.), & Huelin (F. E.). **Investigations on the storage of Jonathan Apples grown in Victoria.**—*Bull. Coun. sci. industr. Res. Aust.* 135, 96 pp., 4 pl., 16 graphs, 1940. [Mimeoprinted.]

This is a progress report on investigations begun in Victoria in 1924 into various factors influencing storage wastage of Jonathan apples [*R.A.M.*, xx, pp. 340, 476; xxi, p. 3] from several climatically different districts. Wastage in these apples is stated to be mainly due to soft scald, breakdown, Jonathan spot, and to a lesser extent to [unspecified] mould and brown heart. Maturity of the fruit at picking was found to be of the greatest importance in relation to all these forms of wastage. The most reliable index of maturity is the respiratory activity of the fruit after picking, but its application is not commercially practicable. A fairly reliable index of maturity of the fruit from a particular district is the ground colour, i.e., the colour of the unblushed portion of the fruit. A special colour chart is supplied with the bulletin showing the four colours: deep green of the immature fruit, which is not very susceptible to storage disorders, but of poor flavour; two shades of green-yellow of the ripening fruit, which gradually improves in taste and texture, but also becomes increasingly susceptible to soft scald and breakdown; and finally the deep yellow of the over-mature fruit, which loses its crisp and firm texture, becoming soft and slightly mealy and still more susceptible to these two disorders. The green-yellow stage of maturity is considered the most suitable for picking. Jonathan spot was observed to develop in both immature and over-mature fruit, while the effect of maturity on mould incidence was variable from year to year. Wastage from soft scald was consistently greatest at a storage temperature of 32° F. and could generally be controlled by storage at 36° to 37°. Maximum development of soft scald was always reached in cool storage between June and July. Breakdown was observed to occur at all temperatures (in some seasons over a range from 32° to 65°) and was always of the mealy type. Its incidence was greatest at 32° and least at 37°, the most mature fruit being the most susceptible. The development of Jonathan spot and mould was increased to a much greater extent by an increase of storage temperature from 34° to 37° than by one from 32° to 34°.

The effects of delayed storage prior to storage at 32° seemed to vary from year to year, the fruit becoming either more or less susceptible to disorders according to the stage of picking maturity. Protracted periods of delayed storage at temperatures of 36° and 45° produced a progressive decrease in subsequent soft scald development at 32°, while at higher temperatures (55° and 65°) scald incidence usually first increased with short periods of delay and then decreased with further delay, the fruit losing its susceptibility more slowly than at lower temperatures. It is considered possible that soft scald may be caused by too sudden cooling. Delayed storage had varying effects on breakdown or mould development. As for Jonathan spot, delayed storage controlled it in immature fruit, but increased it in mature fruit. On the basis of above observations, it is suggested that the practice of leaving the fruit in the shed after picking is to be avoided on account of rapid deterioration in quality after about a fortnight. For overseas export prompt cooling of apples after picking to 36° or 40°

(but not 32° or 34° because of possible development of low temperature disorders, which may occur even after a storage period of nine weeks) is recommended with subsequent shipping at 34° to 36°. For local storage a delayed storing at 36° till the end of April followed by a month at 34° prior to storing at 32° is advocated. It is mentioned that a number of cool stores have adopted this method since 1937 with very satisfactory results.

Gas storage at 36° in concentrations of carbon dioxide as high as 5 per cent. maintained the fruit in better condition than storage in air at the same temperature, but concentrations of 10 per cent. caused serious wastage.

The largest fruit was found to be the most susceptible to breakdown and possibly to soft scald; the smallest appeared to be most susceptible to Jonathan spot. The amount of wastage seemed to vary greatly in different districts and from season to season, and to be independent of the position of the fruit on the tree. Apples from trees yielding light crops were generally more susceptible to breakdown than similar ones from trees bearing heavy crops. The storage life of the Jonathan apple depends on maturity at picking, storage temperature, seasonal and orchard conditions, but, in general, 10 per cent. of wastage develops by the end of September. There was no consistent relationship between wastage and humidity conditions in the store. The cane sugar : acid ratio was correlated with ground colour at picking and with keeping quality of the fruit, but the results showed that differences in amount of wastage between districts cannot be attributed to differences in any chemical constituent.

**16. Konferenz über Bekämpfung von Krankheiten und Schädlingen der Obstbäume.** [16th conference on the control of fruit tree diseases and pests.]—*Schweiz. Z. Obst- u. Weinb.*, li, 6, pp. 93–124; 7, pp. 139–172, 2 diags., 5 figs., 2 graphs, 1942.

At the 16th conference on the control of fruit tree diseases and pests, convoked by the Federal Experiment Station for Fruit Growing, Viticulture, and Horticulture, Wädenswil, and held in Zürich on 31st January, 1942, C. Hadorn reported on the trials conducted during 1941 in eight climatically divergent localities on the treatment of apple scab [*Venturia inaequalis*: *R.A.M.*, xx, p. 411], from which the following practical conclusions are drawn. 'Concentrated' lime-sulphur (32° Beaumé) is recommended as the standard spray, to be applied at a strength of 2 per cent. before and 1 per cent. after the emergence of new growth. For varieties sensitive to lime-sulphur injury, e.g., Sauergrauech, Danzig Kant, Berne Rose, Berlepsch, and Winter Citron, pomarsol (1 per cent. for pre-blossom and calyx sprays, 0·75 per cent. later) may be substituted. Both lime-sulphur and pomarsol may be mixed with 0·15 to 0·2 per cent. copper oxychloride, containing 32 per cent. metallic copper (Bordo-Xex or virikupfer [viricuivre: ibid., xviii, p. 87]) which improves adhesiveness and enhances efficacy. The 'maximum' schedule of eight applications, as opposed to the 'normal' of five, is of great importance for susceptible apple varieties in situations where the scab fungus flourishes; four treatments at short intervals during blossoming will turn the scale in the right direction, while one too few may endanger the crop. Examples are cited in confirmation of last year's conclusions to the effect that late scab occurs exclusively in the train of primary infections, which must be combated by the above-mentioned spring treatments and that, without the latter, belated applications, e.g. at the end of July, will be useless.

R. Wiesmann's large-scale tests to determine the possibility of combining the dormant treatments (4 to 5 per cent. carbolineum plus 2 per cent. copper oxychloride) against apple scab and insect pests showed that satisfactory results could not be achieved in this manner, since the insects can be exterminated only by early applications (up to 6th March at the latest), while in the interests of fungal control it is desirable to wait until the first signs of new growth appear.

C. Hadorn, investigating the mode of operation of the so-called 'reserve spray', which he defines as the 'controlling factor in a scab control schedule, aiming at the

combination of a minimum of summer treatments with a maximum of security', finds the most effective formulae of those tested up to the present to be the original 'blue spray' with 4 per cent. Bordeaux mixture, and the 'brown spray', consisting of 4 per cent. Bordeaux plus 1 per cent. lime-sulphur. The object of this treatment, applied immediately before the emergence of new growth, is to furnish a sufficient 'reserve' of fungicidal material to be liberated and dispersed with every shower during the critical post-emergence to post-blossom period of primary scab infection. Prior to 1939 little was known concerning the proportion of copper requisite for the destruction of the conidia of *V. inaequalis*; in preliminary tests with copper carbonate at Wädenswil, germination was inhibited by the presence of 3·7 gm. in 100 l. water—a very high figure compared with the traces sufficient to inactivate the spores of other fungi, e.g., *Sclerotinia* [*fructicola*] and *Glomerella* [*cingulata*] [ibid., xvii, p. 541]. The German phytopathologist, W. Maier, secured important information on this matter by his combined laboratory and field experiments (*Z. PflKrankh.*, xlix, p. 160, 1939) at Geisenheim [Rhine], where he sprayed pear trees against scab [*V. pirina*] with 6 per cent. Bordeaux mixture immediately before emergence. The copper concentration in rain water dripping from the leaves and branches was found to decrease progressively as time went on, the amounts present in 1 c.c. on 21st April, 8th June, and 13th August being 4·8, 2·4, and 0·4 $\gamma$, respectively. Pyramids and palmettoes lost their copper reserves more rapidly than standard trees, on which the spray deposit on the bark is better protected by the foliage. The texture of the cortex is another important factor in this connexion; the smoother the surface, the more rapid the washing-off of the mixture. According to Maier, 1 or preferably 2 $\gamma$ copper in 1 c.c. water (0·1 to 0·2 gm. per 100 l.) is the lower safety limit for effective scab control, and during the critical period covered by his tests a concentration of 4 to 5 $\gamma$ was present at the time of maximum risk. Confirmatory experiments were undertaken along the same lines at Wädenswil, where the following treatments were given: one Gravenstein standard sprayed with 4 per cent. 'blue', one with 'brown', consisting of 5 per cent. lime-sulphur plus 2 per cent. copper oxychloride, one bush-trimmed Gravenstein and one Golden Pearmain with 6 per cent. 'blue', while one bush-trimmed Kassel Reinette and one Red Astrakhan were merely covered with fishing nets steeped for five hours in 6 per cent. Bordeaux mixture, and one each of the same kind with coco-nut matting similarly impregnated. Rain water was collected from each of the treated trees at the end of every wet day or brief period (a week at the longest) and stored in the refrigerator until required for determination. Analyses by C. Zäch [reported below] showed 0·1 $\gamma$ copper per c.c. to be the minimum dose compatible with safety. The highly susceptible Kassel Reinettes remained entirely free from scab under the impregnated nets and matting, the water dripping from which evidently sufficed to confer protection, whereas a tree of the same variety receiving the 'normal' schedule of treatments contracted 90 per cent. infection. The covered Red Astrakhans showed only slight infection from 18th June until the autumn, whereas those treated in the ordinary way were severely attacked. Seeing that 0·2 gm. copper per 100 l. water is ample to prevent scab infection, the amounts hitherto used for 'reserve' sprays (4 per cent. Bordeaux mixture containing 1,000 gm. and 2 per cent. copper oxychloride with 640 gm. per l.) must be deemed excessive.

C. Zäch tabulates and discusses the results of his analyses of the rain water collected from the trees treated by the various methods described above. The total copper contents per sq. m. for the 4 per cent. 'blue', 'brown', and 'red' (2 per cent. copper oxide) mixtures (standard apples) being 0·914, 0·294, and 0·486 gm., respectively, or calculated per tree, 18·3, 5·9, and 9·7 gm., respectively, the corresponding figures for bush-trimmed trees covered with (*a*) nets, (*b*) matting, or (*c*) sprayed with 6 per cent. 'blue' being 0·16, 0·143, and 1·38 gm. per sq. yd. or 2·0, 1·8, and 17·4 gm. per tree.

C. Hadorn's observations showed that no leaf injury worth mentioning was caused by the intensive treatment of Boiken, Gravenstein, Golden Pearmain, and Danzig

Kant apple trees with lime-sulphur alone or in combination with iron sulphate, lead arsenate alone, lime-sulphur or pomarsol with nirosit (a new German insecticide, also known as No. 23.52), or pomarsol with lead arsenate, whereas mixtures of lime-sulphur and lead arsenate tend to induce severe injury under favouring climatic and environmental conditions. Recent determinations by C. Zäch further point to the importance of the water-soluble copper content and the hydrogen-ion concentration of the mixture in relation to spraying damage, the maximum amount of copper consistent with safety being less than 0·5 per cent. and the most suitable reaction about $P_H$ 7·0. Preparations complying with these conditions in the 1941 trials included 0·15 to 0·2 per cent. copper oxychloride, bordo-xex, bordofix, oxykupfer, viricuivre, cryptocid, estafat, and the 1934 and 1938 brands of cupromaag.

PEGLION (V.). **La base biologica della lotta contro la ticchiolatura del Melo e del Pero.** [The biological basis of the campaign against Apple and Pear scab.]—*Ital. agric.*, lxxix, 1, pp. 9–14, 1942.

Following a survey of outstanding developments in the life-histories of apple and pear scab (*Venturia inaequalis* and *V. pirina*) as described in the relevant literature, the writer summarizes and discusses the results of large-scale orchard experiments in the control mainly of the first-named in the Ferrara district of Italy in the spring of 1941, when meteorological conditions were exceptionally favourable to the progress of the disease. The standard Bordeaux mixture schedule, consisting of a 2 per cent. dormant application, another at the opening of the buds at 0·5 to 0·8 per cent., and a third at the same strength when the flowers were beginning to unfold, produced an excellent crop, but the winter treatment was experimentally shown not to be indispensable provided the spring spraying was punctually carried out. This statement is not applicable to the control of *V. pirina*, at any rate on susceptible pear varieties, for which the dormant treatment of 2 per cent. Bordeaux mixture plus ammonium chloride or sulphate is a necessity. Of recent years the increasing copper shortage has induced many fruit-growers to treat apple scab with lime-sulphur instead of Bordeaux mixture, but there is considered to be no justification for such a measure, which has been attended by serious consequences in the case of varieties susceptible alike to *V. inaequalis* and lime-sulphur injury, e.g., Commercio, Imperatore, Rome Beauty, Calvilla, Rambour F., Abbondanza, and Renetta Walder. Particularly good results were obtained by the use of Bordeaux mixture, commencing at a strength of 0·7–1–100 and decreasing to 0·5–0·8–100, two applications being given before the blossom, one at the close of flowering, and subsequently at ten-day intervals, except in the case of sensitive varieties, such as Gravenstein and Imperatore, which developed severe russeting of the fruit, the foliar scorching due to the same cause being quite transient. G. Gerbaldi's experiments at Ravenna in 1940–1 (on which much of the information here presented is based) showed that the best fungicide for Black Ben Davis, a hypersensitive variety as far as scorching injury is concerned, is a cold mixture of sulphur and lime.

In the autumn of 1940 abundant conidial rudiments of *V. inaequalis* and *V. pirina* were observed for the first time in the Trentino on apple and pear branches, respectively, and by the following May were in full fructification.

YEAGER (A. F.). **Mild versus lime-sulphur.**—*Amer. Fruit Gr.*, lxii, 2, pp. 16–17, 1 fig., 1942.

Flotation and other forms of mild sulphur are being largely substituted for lime-sulphur in the control of apple scab [*Venturia inaequalis*] in New Hampshire [*R.A.M.*, xx, p. 104]. The yields of clean McIntosh and Northern Spy fruit sprayed for five and seven years, respectively, with flotation and lime-sulphur amounted to 95 and 97 per cent., respectively, of the crops, the slight difference in favour of lime-sulphur mainly resulting from the poorer control afforded by the flotation product (10 per cent.

diseased fruit) in one season of very severe infection. The average reduction caused by foliar injury in the yield of lime-sulphur-sprayed McIntosh trees over a three-year period was more than a box per tree as compared with flotation sulphur, a difference of 20 per cent. In a five-year test McIntosh flotation sulphur-sprayed trees yielded more than an additional box of fruit, an increase of 17 per cent. over those treated with lime-sulphur, while Northern Spy trees receiving flotation sulphur over a seven-year period outyielded those to which lime-sulphur was applied by three boxes per annum or 40 per cent. Some of the newer types of mild sulphur with small particles are superior to flotation and almost equal to lime-sulphur for scab control, even in bad seasons, but the coarse wettable brands are less satisfactory, the percentage of clean fruit from trees treated with them falling as low as 60 per cent. in some years.

SAVAGE (E. F.) & COWART (F. F.). **Factors affecting Peach tree longevity in Georgia.**—*Bull. Ga Exp. Sta.* 219, 15 pp., 7 figs., 1942.

Winter injury, in its two forms of crown damage and sunscald or south-west injury, is the major factor in the heavy losses in the peach orchards of Georgia. The former, predominant in the southern part of the State, results from immaturity of tissues occasioned by late or partially resumed growth preceding sub-freezing temperatures, whilst the latter is generally attributed to high temperature during sunny days in winter followed by sudden frosts at night. In north Georgia erosion is a factor operating to bring about the death of winter-injured trees. Rootstocks not resistant to cold injury are liable to another type of winter injury. Strong winds in the autumn may rock the tree and cause the formation of a pocket round the tree into which the cold air penetrates causing death. Other factors of less importance are crown gall [*Bacterium tumefaciens*] and phony disease [*R.A.M.*, xvii, p. 125], trees affected by either of which should be promptly destroyed. During the period 1938 to 1940 inclusive 68 (0·008 per cent.), 39,860 (0·38 per cent.), and 134,168 (1·74 per cent.) trees infected with phony disease were found in north, central, and south Georgia, respectively. Prolonged dormancy or delayed foliation due to insufficient hours of cold below 45° F. is a factor in longevity in some varieties.

ROBERTS (J. W.). **The ascogenous stage of the Peach constriction-disease pathogen.**—*Phytopathology*, xxxii, 4, pp. 335–336, 1 fig., 1942.

A culture of the species of *Phomopsis* causing constriction disease of peach [*R.A.M.*, xx, p. 310] was obtained from Delaware and transferred to oatmeal agar on 4th December, 1940, a sterilized fragment of peach twig being added five days later. After a month typical pycnidia developed both on the agar and the twig and in September, 1941, subspherical perithecia, typical of *Diaporthe*, were found on the two substrata. The paraphysate asci were clavate, with a refractive ring in the apical wall, 49 to 57 by 8 to 10 $\mu$, and contained uniseptate, 4-guttate, biseriate ascospores, 12 to 13 by 4 $\mu$. On the basis of these characters the fungus is tentatively referred to *D. perniciosa*.

BODINE (E. W.) & NEWTON (J. H.). **The rasp leaf of Cherry.**—*Phytopathology*, xxxii, 4, pp. 333–335, 1 fig., 1942.

In 1935 Royal Ann cherry trees in Delta County, Colorado, were observed to be affected by foliar abnormalities which subsequently spread, though in a milder form, to the Bing and Lambert varieties, extension of the disorder in the Paonia district being rapid in 1940–1. The most prominent symptom is the enations, ranging from elongated protuberances to raised, serrate, leaf-like growths on the under sides of the foliage, which usually radiate outwards from the midrib towards the margins and are mostly furnished with apical glands. The upper leaf surface bears sunken rugosities of an abnormally pale colour, exactly corresponding to the dorsal outgrowths, the likeness of which to the teeth of a coarse rasp suggested the designation of the trouble.

Severely affected leaves are small, narrow, and malformed, the lamina frequently tending to fold upon itself ventrally. Bud-inoculation tests point to a virus with a two-year incubation period as the agent of the disease.

KING (MARY E.) & HARRIS (R. V.). **Studies in Strawberry virus diseases. IV. Symptom expression of yellow-edge in the variety Royal Sovereign.**—*J. Pomol.*, xix, 3 & 4, pp. 212–226, 4 graphs, 1942.

After reviewing earlier observations made at East Malling on yellow edge of the Royal Sovereign strawberry [*R.A.M.*, xx, pp. 72, 586], the authors give a full account of their further studies on the subject. As a general rule affected plants gradually deteriorate, the symptoms becoming more marked as the plants age. However, not all plants that show mild to moderate yellow edge in their maiden year develop more severe symptoms later. Some appear to be affected with a mild form which does not become progressively worse. Hence, symptom intensity among the individuals of a set of diseased plants may vary at any one time. That these variations are not due to differences in nutrition was demonstrated. It was observed that wild strawberries (*Fragaria vesca*) were never found to be naturally infected when growing in woods, but in the greenhouse and in experimental plots readily became infected by grafting or by attack by viruliferous strawberry aphids [*Capitophorus fragariae*]. Wild and Royal Sovereign strawberries planted out in a cleared, cultivated patch of woodland were discovered by aphids and most of the plants became infected, while in other ground in the vicinity, where the natural vegetation had otherwise not been disturbed, wild strawberries and Royal Sovereign were not found by aphids, and remained healthy. The natural freedom from attack of *F. vesca* would, therefore, seem to be related to the behaviour of the strawberry aphid, rather than to a nutritional difference between cultivated loam and virgin woodland soil. When healthy and infected wild and Royal Sovereign plants were grown in pots containing (1) good greenhouse compost, (2) woodland soil, and (3) peat, no differences in symptom expression resulted as between the different soils, there being much greater variation in any one soil than between plants in different soils.

The possibility that two or more strains of the virus differing in virulence might be involved was investigated. Two clones of Royal Sovereign, mildly and severely affected [ibid., xxi, p. 3], respectively, were used along with healthy plants of the Malling 35 clone. Mildly and severely affected plants were grafted together in pairs by stolon inarching, while healthy plants were also grafted to each infector. Controls were set up in which two mild infectors were grafted together, with a healthy plant grafted to each. The results obtained did not support the view that a protective action is exercised by mildly affected plants against infection from severely affected ones, but they did show that the two different types of symptoms behave in a constant fashion. Other clones, however, from mildly affected parents contained some plants that developed severe symptoms and some clones from severely infected parents gave mildly affected plants. It seems possible, therefore, that if different strains of virus are present, they are present as a mixture, except for the consistently mild clone, which may be pure.

Two seasons' observations in the field on plants of clone Malling 35 free from yellow edge but affected with mild crinkle (set *a*), plants showing mild yellow edge (*b*), and severe yellow edge (*c*) planted out in randomized blocks showed that on the whole plants of sets *a* and *b* classified as mild in 1938 were still mild in 1939, though some had become severely affected. The plants severely affected in the first year mostly remained so in the second. Again no apparent resistance was shown by mildly infected plants, as compared with healthy ones, towards infection with more severe strains. Apparently, once a plant shows typical symptoms, either mild or severe, in one season, it tends to keep them in the following year; they may become one stage worse, but they remain in the same category.

The immediate result of infection is flattening of the plant, followed later by dwarfing; both processes become progressively more marked as the symptom expression intensifies. Affected plants also show a considerably reduced runner production.

In Royal Sovereign strawberries high susceptibility is combined with well-marked symptom expression. The symptoms are, however, sometimes masked, this characteristic being related to the interaction of three factors, (*a*) seasonal weather conditions, (*b*) soil conditions, especially soil moisture, and (*c*) the age of the infected plants. Some infected plants generally develop symptoms in early summer; a period follows when the symptoms decrease, after which they become more conspicuous again in autumn. This fluctuation is related to temperature and soil moisture conditions, symptom expression being encouraged by damp weather, and inhibited or reduced by hot, dry weather. A preliminary roguing of established runner beds should be effected in June, and the final inspection and roguing made in September and October. New plantings of runners should be similarly inspected and rogued. Under uniform seasonal conditions maiden plants that become infected are less likely to show symptoms than comparable two-year-old plants, so that roguing will probably prove more effective on two-year-old runner beds than on maiden ones.

HARRIS (R. V.) & KING (MARY E.). **Studies on Strawberry virus diseases. V. The use of Fragaria vesca L. as an indicator of yellow-edge and crinkle.**—*J. Pomol.*, xix, 3 & 4, pp. 227–242, 2 pl., 1942.

Experiments are described in which strawberry plants of different varieties under trial at East Malling were tested for the presence of yellow edge and crinkle [see preceding abstract] by grafting to possible indicator plants, chiefly the wild *Fragaria vesca* [*R.A.M.*, xvi, p. 761].

The results obtained have in part been reported from other sources but the following points may be mentioned. Crinkle symptoms in *F. vesca* vary in intensity [ibid., xviii, p. 464], but include different types, one of which usually predominates. The two most prominent types are a dark green puckering of the leaf laminae, frequently with slight thickening in the darker green, raised areas, and light yellow-green chlorotic spots which develop irregularly. Some twisting and curling of the laminae may develop, or these parts may remain flat and dwarfed and turn very red near the veins. The more severe the attack, the more dwarfed the whole plant becomes, whatever the dominant symptom type.

The symptoms of yellow edge in *F. vesca* are less simple to classify, and occasionally it was difficult to distinguish between plants showing crinkle alone and those infected with both viruses. *F. vesca* indicator plants grafted to a plant affected with yellow edge and crinkle were grouped into three stages. In stage 1, developed after three to four weeks, the leaves are not reduced in size, but the midrib of each leaflet is curled backwards and downwards, so that the whole leaf has a rounded outline when seen from the side, as opposed to its normal, flat appearance. Such leaves generally show prominent, dark green, raised-up areas. Sometimes chlorotic speckling is also present, this probably being due to the crinkle virus. The leaf curling is the distinct feature due to the yellow-edge virus, and has not been seen on plants affected by crinkle alone. On each *F. vesca* indicator one to three leaves may develop symptoms of this stage; these symptoms persist as long as the leaf remains, and do not develop further.

In stage 2, the leaves are not curled but are one-half or one-quarter the normal size. They are asymmetrical, and the leaflets are sometimes arranged asymmetrically on the petiole. The usual symptoms of local laminal bulging (puckering), chlorotic spotting, and reddening may also be present. Such leaves may be more numerous than all other types of leaf.

Stage 3, which is the final one, is not always reached. In this the leaves are extremely minute and the laminae greatly reduced or wanting. Sometimes these leaves do not even show typical crinkle symptoms but are just very small, smooth, green

leaves, reddened in the region of the veins. In some cases, if most of the leaves are in stage 3, the laminae of all the previously healthy leaves and of those in stage 1 may have fallen off, leaving the bare petioles; such plants often die early.

The viruses do not appear visibly to affect fully developed leaves, but only those developing at or after the time when infection takes place, and it is thought that leaves with stage 1 symptoms were already partially developed at the time of infection. At any stage bending and twisting of the tips of the young developing stolons may be present, and young runner plants produced by these stolons are severely affected, their leaves showing stage 2 or stage 3 symptoms.

In the course of experiments with diseased plants of the American varieties, Premier, Fairfax, and Dorsett, some, when grafted to *F. vesca* indicators, induced symptoms of a new kind. In the indicator plants all the leaves were curled and dwarfed, and not puckered or chlorotic-spotted, but yellowish-green. The entire plant developed a matted, tussocky appearance. It is thought that this condition may be due to yellow-edge virus being present alone.

Certain selections of the susceptible varieties Royal Sovereign, Sir Joseph Paxton, and King George induced no visible reaction in *F. vesca*, and were therefore considered to be virus-free. Selections of certain varieties that showed no symptoms transmitted disease when grafted to *F. vesca*; nearly all the selections of such carrier varieties induced symptoms in *F. vesca*, but one strain of Huxley's Giant appeared to be free from any virus, and is being propagated for further trials.

During this work ample evidence was obtained which demonstrated that strawberry species and varieties differ markedly in their resistance to, or tolerance of, these viruses. No hard-and-fast line can be drawn between tolerant and susceptible varieties, which constitute a graded series from very susceptible intolerants to varieties carrying the virus without showing any symptoms.

Leach (R.). **Banana leaf spot. When to spray and why.**—[*Pamphl.*] *Leaf Spot Control Div. Dep. Agric. Jamaica*, 5 pp., 8 diags., 1942.

This popular account of banana leaf spot (*Cercospora musae*) emphasizes some important features in the life-history of the causal organism in relation to the work of control in Jamaica [*R.A.M.*, xxi, p. 242]. The bulk of infection, both from conidia and ascospores, occurs on the under leaf surfaces during or just after unfurling. The ascospores are expelled from the perithecia, generally in the still atmosphere of the early morning, and are borne upwards by light air currents, which sometimes convey them to plants higher up on the slopes of steeply inclined sites, but under windy conditions the dispersal of the spores is so widespread as to admit of heavy infection only between closely adjacent plants. The conidia produce foliar spotting, mainly linear, throughout the year; they may be dislodged from the lesions by leaf friction and carried away by the wind, but the ordinary mode of dissemination is by splashes of rain or dew. The lines formed by the conidial infections are mostly parallel to the edge on the left side of the leaf (viewed from the stem) and extend diagonally across it on the right. The ascospores produce apical spotting, principally between August and February, this feature of the disease being most conspicuous on tall plants and the conidial lines on shorter ones. Foliar scorching follows the production either of a large number of densely aggregated spots or the separation of part of the leaf from the main vein by a line of lesions. The leaves of rapidly developing young plants do not usually show heavy spotting until they have been five to six weeks in the open, while in older or slower growing ones the period of quiescence may be prolonged up to two months. This delay in the appearance of the symptoms is a noteworthy feature of leaf spot, indicating as it does that an access of infection is only observed six to eight weeks after its actual occurrence.

Sprays check the disease by (1) preventing or lowering the production of conidia and by rendering the dew poisonous to those coming in contact with it before they are

detached from the leaf, and (2) killing the conidia and ascospores that have settled on but not infected the leaf or may subsequently settle on the sprayed leaf. The results of experiments have shown that normal spraying is very effective in controlling the disease except in the ascospore season (August to February). If the disease is well under control by the end of August, comparatively little spraying may be required between then and the following March, whereas if the disease is not controlled by the end of August normal spraying is unable to control ascospore infection effectually up to the end of January. In order to prevent the production of ascospores it is important to remove all trash from the plants by August and bury it. Further removals should be made when required until the end of December. On the basis of these results spraying is recommended as follows. First intensive spraying (at the rate of 90 gals. per acre except where otherwise stated) on 2nd and 23rd March, 6th April, 27th April (3 leaf; 50 gals.); second intensive spraying on 15th June, 6th and 20th July, 3rd and 24th August, 14th September, and 5th October (the last three at 50 gals. per acre); and precautionary spraying on 7th December and 11th January. This represents 13 sprayings per annum but a further reduction to 10 sprayings may be sufficient in the following year.

PARRIS (G. K.). **Phytophthora parasitica on Papaya (Carica papaya) in Hawaii.**—*Phytopathology*, xxxii, 4, pp. 314–320, 3 figs., 1942.

Some of the information in this account of the fruit and stem rot of papaws in Hawaii caused by *Phytophthora parasitica* has already been presented from another source [*R.A.M.*, xxi, p. 150]. Inoculation experiments with pure cultures of the fungus gave positive results on the stems, fruits, roots, and leaves of both wounded and unwounded plants, infection of the latter being promoted by maintenance in a humid atmosphere: the pathogen was recovered from a number of lesions thus induced.

YARWOOD (C. E.). **Stimulatory and toxic effects of copper sprays on powdery mildews.**—*Amer. J. Bot.*, xxix, 2, pp. 132–135, 1942.

After stating that he has secured control of several powdery mildews [*Erysiphe* spp.: cf. *R.A.M.*, xviii, p. 465] with copper and sulphur fungicides used as eradicant or protective treatments (unpublished data), and pointing out that copper fungicides are particularly useful against these diseases on sulphur-sensitive crops such as cucurbits, the author describes experiments in which bean plants were inoculated with a strain of *E. polygoni* from clover (*Trifolium pratense*) and another from bean (*Phaseolus vulgaris*), and then treated with copper sprays and dust. Both the treatments and the inoculations were carried out when the primary leaves were about two-thirds of full size.

The results obtained were as follows. The conidia of clover powdery mildew dusted on the surface of 7 c.c. of test solutions in Syracuse watch glasses and held for 10 hours in diffuse daylight gave the following germination values (average of five tests): water, 42 per cent.; 0·1 per cent. copper sulphate, 46 per cent.; 1 per cent. copper sulphate, 31 per cent.; 0·1 per cent. mercuric chloride, 31 per cent.; and 1 per cent. mercuric chloride, 4 per cent.

On glass slides the dried deposit from 0·1 per cent. Bordeaux mixture+0·1 per cent. cottonseed oil was highly toxic when water was added to the slides along with the conidia of the clover powdery mildew and the slides were inoculated at 100 per cent. relative humidity. The same deposit was, however, highly stimulatory when the dry slides with dry spores were incubated at 90 per cent. relative humidity. Intermediate results were obtained at 100 per cent. relative humidity, in the absence of free moisture. The bean mildew gave analogous results. Similar dosages of Bordeaux mixture

without cottonseed oil were only slightly, if at all, stimulatory, and similar dosages of copper in the form of cuprocide dust were toxic in all environments. All three forms of copper were toxic in all environments to barley powdery mildew (*E. graminis*).

Copper sulphate and Bordeaux mixture at various dosages were suspended in 2 per cent. sucrose agar, and the poured plates dusted with bean powdery mildew conidia. In one typical test the percentage germination on sucrose agar containing 0·06 per cent. Bordeaux mixture was 71 per cent., as against 50 per cent. in the controls, and the average lengths of the germ-tube were 63 and $58\mu$, respectively.

When light was sufficiently strong to inhibit mildew development after inoculation, bean plants sprayed with 0·1 per cent. Bordeaux mixture often showed more mildew than unsprayed plants. Bordeaux mixture was more effective as an eradicant than as a protective spray for bean mildew, no mildew stimulation being observed when Bordeaux mixture was used as an eradicant spray.

These results emphasize the importance of experimental conditions in the study of fungicides, since it shows that a given dose of copper may be toxic, neutral, or stimulatory to the powdery mildews studied, according to the environment and other conditions of the test.

Roberts (J. W.). **Substitutes for copper and zinc in fungicidal sprays.**—*Industr. Engng Chem.*, xxxiv, 4, pp. 497–498, 1942.

Of recent years the writer and his colleagues at the Bureau of Plant Industry, United States Department of Agriculture, Beltsville, Maryland, have tested several hundred organic materials with a view to their potential fungicidal uses, and the results obtained are of interest in view of the threatened shortage of copper and zinc for fungicidal sprays. One of the most promising is phenothiazine, which has given fair control of apple scab [*Venturia inaequalis*], shown some degree of efficacy against bitter rot [*Glomerella cingulata*], and been effective in mild cases of cherry leaf spot [*Coccomyces hiemalis*]. Its principal weakness (apart from present scarcity and prohibitive cost) is lack of adherence, which has lately been much improved by finer grinding. Dinitro compounds may also form the basis of successful fungicides, the water-soluble sodium salt of dinitro-ortho-cresol [elgetol], for instance, being destructive to fungi in fallen leaves [e.g., *V. inaequalis* on apple foliage: *R.A.M.*, xxi, p. 245]. The thiuram disulphides [see next abstract] merit further investigation as orchard fungicides: tetramethylthiuram disulphide, recently reported as effective against turf pathogens [*Corticium solani* and *Sclerotinia homoeocarpi*: ibid., xx, p. 367], has likewise proved toxic to fungus spores in the author's tests, but causes injury to apple, peach, and cherry leaves and fruit in combination with lime or lead arsenate. Mention should further be made of the thiocarbamates, one advantage of ferric dimethyl dithiocarbamate [see next abstract] over all the other substances tested being its satisfactory spreading and adhesive properties.

Tisdale (W. H.) & Flenner (A. L.). **Derivatives of dithiocarbamic acid as pesticides.**—*Industr. Engng Chem.*, xxxiv, 4, pp. 501–502, 1942.

Investigations by the du Pont Company since 1931 have revealed a marked degree of specificity in relation to different kinds of pests among members of the dithiocarbamic acid group of organic sulphur compounds [see preceding abstract], while their fungicidal efficiency was reduced by the replacement of one or both alkyl groups by those of aryl. In laboratory tests sodium dimethyl dithiocarbamate was lethal to the spores of barley covered smut (*Ustilago hordei*) at a dilution of 1 part to 30,000 of water, twice the concentration being necessary to produce comparable results with tetramethylthiuram monosulphide, which was also effective at a strength of 0·8 per cent. in alcohol solution against *Trichophyton* and other skin infections; similar results were obtained in the therapy of dermatomycoses with tetraethylthiuram

monosulphide and sodium dimethyl dithiocarbamate. Tetramethylthiuram disulphide has been reported to be highly effective against tulip 'fire' (*Botrytis tulipae*) in Europe, while good results have also been secured in tests on apple scab [*Venturia inaequalis*]. Limited experiments with tetraethylthiuram monosulphide (0·2 per cent.) were successful in combating rose mildew [*Sphaerotheca pannosa*]. Cherry leaf spot [*Coccomyces hiemalis*] and brown rot of stone fruits [*Sclerotinia fructicola* and *S. laxa*] yield to treatment with ferric dimethyl dithiocarbamate [*R.A.M.*, xxi, p. 296], which has also given promising indications as a remedy for apple scab at the rate of 1 to 1½ lb. per 100 gals. solution. This extremely finely divided product adheres exceptionally well to foliage and fruit without adjuvants.

Janke (F.). **Die mikrobielle und fungizide Wirkung des Kalkstickstoffs.** [The microbial and fungicidal action of calcium cyanamide.]—*Zuckerrübenbau*, xxiv, 3, pp. 29–40, 3 figs., 1942.

The writer summarizes investigations conducted (mostly in Germany) into the beneficial effects of soil treatments with calcium cyanamide on the health of crops suffering from various well-known diseases, and the stimulatory action of the compound on the more desirable bacterial members of the soil microflora, as opposed to moulds and fungal pathogens.

Weston (W. H.). **A Petri dish holder for mechanical stages.**—*Science*, N.S., xcv, 2468, pp. 415–416, 2 figs., 1942.

The Petri dish holder described in this paper consists essentially of a spring steel clip fixed to a frame which fits into a slide-holder of the mechanical stage. The frame, made of sheet brass, has a horizontal base, 3 by 1 in., with one side cut away to accommodate the dish, and is provided with three bent-up ears to which the clip, of suitable length and curvature tightly to encircle the dish, is soldered. This holder may be conveniently modified for special purposes. Thus, the frame might be screwed to a brass strip that fits into the stage slot in place of the usual slide-holding fingers, or the clip might be attached, as in a model independently devised by Dr. E. Runyon of Agnes Scott College, to a small bakelite block screwed to one of the slide-holding fingers of the mechanical stage, while for holding the uncovered plate upside down to avoid contamination a holder that supports the plate at a height of about 1 in. is described.

Cash (Mary). **A simple method for determining the growth rates of fungal colonies at different hydrogen ion concentrations.**—*Aust. J. Sci.*, iv, 4, pp. 135–136, 1942.

The following technique was devised at the University of Sydney to eliminate as far as possible the effect of staling substances on the growth of fungal mycelia in nutrient media. A single spore of the fungus is inoculated on the centre of a disk of moistened plaster of Paris poured into a circular mould 55 mm. in diameter and 6 mm. in depth, and growth is measured as the average diameter of five colonies. To facilitate these calculations two diameters of the disks at right angles are marked in mm., and the entire surface marked in mm. squares with a lead pencil, the disks then being placed in Petri dishes and autoclaved. A prepared buffer solution is poured into a sterilized Petri dish to just beneath the upper surface of the disk, care being taken to avoid flooding. The method was successfully used for the determination of the effects of the hydrogen-ion concentration on the growth rate of *Gloeosporium album* and *Penicillium expansum* at 20° C. in potato dextrose solution buffered by disodium phosphate and citric acid ($P_H$ 2·6 to 4·0). To obviate any possibility of nutrient starvation the disks were daily transferred to Petri dishes containing the requisite amount of fresh medium.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
OF
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Dobbs (C. G.). **On the primary dispersal and isolation of fungal spores.**—*New Phytol.*, xli, 1, pp. 63–69, 1 fig., 1942.

In discussing the dispersal methods of fungal spores in air and water, distinctions are drawn between primary dispersal, by which the spore is carried away from the parent body, and secondary dispersal, which applies to all subsequent distribution after the spore has once come to rest; and also between active dispersal, when the fungus supplies the initial energy, and passive dispersal due to movements or actions of the surrounding medium or other organisms, e.g., insects. Passive spore dispersal in the air was studied with the aid of a simple insufflator (blower) by means of which spores were blown gently in still air and the fungi were tentatively grouped according to type of dispersal as follows: (1) spore-retainers (the least numerous group), which shed no spores in air under any circumstances; (2) spore drop-shedders, which are spore-retaining in general, but scatter spore-containing drops when moist and subjected to rather strong blowing or shaking of their support; (3) dried spore-shedders, which shed few or no spores when moist, but many when dry and subjected to gentle blowing; and (4) spore-shedders (the most numerous group), which shed some spores in still air as soon as they are produced on the moist colony, and many more when subjected to gentle blowing. Methods of spore dispersal were also grouped according to the parts played by water and air in the process, namely, group 1, dispersal of spores immediately by water; group 2, by air bubbles in water as in working yeasts; group 3, dispersal of spores in spore drops or slimy masses by natural water; group 4, dispersal of spore drops in air by (*a*) animals or other solid objects, and (*b*) air currents or shaking of their support; group 5, dispersal of spores by air from spore drops that have dried *in situ*; and group 6, dispersal of individual spores by air, each directly from its own point of attachment.

The blower mentioned above consists of a Pyrex glass tube containing a plug of cotton wool and provided with a rubber bulb at one end and two prongs of tungsten wire fused into the other end. After flaming the wire and adjacent parts, a tuft of aerial mycelium is picked up by the prongs, or a piece of culture medium placed on them, or the sporing surface of a culture is touched with sterile cotton wool borne on the prongs. The end of the tube is then inserted under the lid of a Petri dish and one gentle puff is all that is needed to inoculate the medium. The method provides a simple means of isolating spores and separating spore-shedding fungi from spore-retaining ones or from moist bacterial colonies.

Melchers (L. E.). **Climate in relation to plant diseases.**—*Trans. Kans. Acad. Sci.*, xliv, pp. 172–182, 1 graph, 1941.

Following a general survey of the relation of environmental factors to plant diseases, the writer cites a few examples of the influence of soil and meteorological conditions on the development and distribution of some important fungal pathogens in the

United States. Onion smut [*Urocystis cepulae*], first detected in Massachusetts 50 years ago, and now widespread in the north, is spread by means of diseased bulbs, especially sets, yet these are annually introduced into Louisiana and Texas without giving rise to serious infection, since the soil temperatures prevailing in those States during the critical germination period of the seed are above the maximum (29° C.) for the growth of the fungus [*R.A.M.*, xviii, p. 367], which can only enter its host below ground and through the young parts of the cotyledonary leaf.

The optimum temperature for the vegetative development of flax is 20°, while severe attacks of the wilt fungus [*Fusarium lini*] are favoured by a range from 24° to 28°, so that the absence of the disease from fields with soil temperatures of 12° or 38° (the minimum and maximum for the growth of the host) may be partially due to conditions adverse to the parasite, while on the other hand, the host may undergo certain changes at these points tending to confer resistance.

The fact that wheat bunt [*Tilletia caries* and *T. foetida*] will occur in one field and not in another across the road, or even in only one part of the same field, assuming the same seed to have been used, is undoubtedly attributable to the variations in soil temperatures resulting from sowing on different dates. In 1926 at Manhattan, for instance, no infection developed in plantings of Kanred sown on 4th and 11th September, when the average soil temperatures for the seven days after sowing were 75·30° and 70·25° F., respectively, whereas the incidence in the plantings sown on 9th and 31st October and 7th November at temperatures of 46·60°, 38·21°, and 35·78°, respectively, was 79·65, 71·12, and 82·84 per cent., respectively. This knowledge has an important bearing on the programme of breeding bunt-resistant varieties, an essential feature of which is the planting of the material at the critical period in each autumn for the establishment of the pathogens. Careful study of the soil-air thermograph charts with the above-mentioned facts in mind insures the planting of the bunt nursery at the correct time. In this connexion it is of interest to note that the autumn of 1940 was unusually warm, and by 16th June, 1941, it was evident that bunt would be of minor importance in the State. Excellent infection, however, was obtained in the bunt nursery, the planting of which was deferred until the advent of cooler conditions.

The immediate lowering of the soil and air temperatures of tomato greenhouses to below 77° on the detection of the wilt fungus [*F. bulbigenum* var. *lycopersici*: see below, p. 393] will partially or completely save the crop, since the pathogen develops most rapidly at 88°. The following year resistant varieties should be grown or the soil sterilized to destroy the fungus.

Potato scab [*Actinomyces scabies*] is very severe in soils with a moisture content of 14 per cent. at the time of tuber-setting, whereas at 34 per cent. the disease is absent. The writer has followed the development of a 400-acre peat farm in Minnesota, the reclamation of which from a swamp was begun in 1914: by 1924 partial drainage had been effected, and for the first three years excellent potato crops were produced, but as the water table gradually sank from its original high level, only 14 to 18 in. below the surface, scab became prevalent and caused extensive deterioration in the yield and quality. In 1931, at the writer's suggestion, a steel flood-gate was installed in the main ditch at the outlet, the water in which was regulated in the spring and summer so as to back up the water into the tile lines and raise the water table of the land. The first year after this step was taken the disease almost disappeared, and since then it has never occurred in sufficient abundance to reduce the market grade below U.S. No. 1.

Studies on the wheat scab and maize seedling blight caused by *Gibberella saubinetii* have shown that wheat seedlings contract infection in a warm soil but not in a cold one, while those of maize react positively to infection in a cold but not in a warm soil. This is an instance of the environment affecting the host and thereby modifying its response to the parasite. The latter is at its best at a high temperature, and it is the

chemical changes taking place in maize seedlings under cool conditions that stimulate the fungus, which is actually weaker than usual. On the other hand, in the case of wheat scab, the host is enfeebled and the pathogen fortified by high temperatures, with the results that would be expected.

Another instance of the effect of a change in environment on the parasite-host relationship is afforded by Marquis (spring) wheat, which is highly resistant to bunt when sown at its normal time in the spring, but becomes susceptible on planting in the autumn, a practice sometimes adopted in warm climates [ibid., xxi, p. 133].

Loose smut of wheat [*Ustilago tritici*] has steadily increased in the hard wheat belt of Kansas during the last seven years, apparently owing to the abnormally heavy precipitation during that period, though the possibility of the development of new physiologic races of the smut cannot be excluded.

The author's observations on the relation of environmental conditions to recent outbreaks of stem rust of wheat [*Puccinia graminis*] have been summarized from another source [ibid., xxi, p. 248]. A statement of interest in this connexion is that the Hope variety, used as a source of resistance in wheat-breeding programmes, exhibits virtually no trace of this property when grown in the fog belt of Peru, showing the adverse effect of low light intensity.

Bean [*Phaseolus vulgaris*] anthracnose [*Colletotrichum lindemuthianum*] may be largely controlled by the use of healthy seed, now obtainable from the arid regions of Idaho, Montana, and California, where the crop is extensively grown under irrigation and thrives better than in the more humid climates of the east and middle west.

Lindegren (C. C.). **The use of the fungi in modern genetical analysis.**—*Iowa St. Coll. J. Sci.*, xvi, 2, pp. 271–290, 1 diag., 1942.

Although fungi are pre-eminently adapted for genetical experiments, they have been much less frequently used for this object than *Drosophila* and maize owing to the inapplicability to such widely different organisms of the methods in common use. With a view to elucidating the problems incidental to the genetical analysis of fungi, the writer outlines some important aspects of their cytology and modes of inheritance, with special reference to his work on *Neurospora* (chosen on account of its short life-cycle, permitting the development of mature offspring in two to three weeks after mating), including hyphal fusion, heterokaryosis, asexual and sexual cycles; segregation in the ascus, chromosome maps and chromosomes, homokaryotic strains, production of mutations in fungi, techniques for the separation of heterokaryons, variety of mutant forms, classification of progeny by elimination, aberrant segregation ratios, tetrad analysis, and X-ray and ultra-violet-induced mutation.

Hildebrand (E. M.) & Curtis (O. F.). **A darkening technique for inducing virus symptoms in mature as well as in growing leaves.**—*Science*, N.S., xcv, 2467, p. 390, 1942.

In experiments on the transmission of the yellow-red virosis or 'X' disease of peach [*R.A.M.*, xx, p. 540] it was found that darkening the upper half of young, rapidly growing peach seedlings, which had received a diseased bud midway on the stem, induced symptoms in the shaded part sometimes within four weeks from the time the shading began. Similarly, darkening one of the branches of older non-growing seedlings, which had received a diseased bud near the base of the branch, induced symptoms within six weeks. In both cases the shading was maintained for only two weeks and it is believed that this time can be still further reduced. As an explanation of the observed facts, it is suggested that the movement of the virus in the plant is associated with that of carbohydrate. Shading a portion of a plant stops photosynthesis in that part and favours the transport of carbohydrate from the unshaded into the shaded parts. When, on its way, the food passes a diseased bud, it receives and carries the virus along into the shaded part of the plant. It is suggested that temporary darken-

ing to induce entrance of the virus and the development of disease symptoms in non-growing as well as growing tissues represents an important transmission technique for the study of plant viruses.

JOHNSON (J.). **Studies on the viroplasm hypothesis.**—*J. agric. Res.*, lxiv, 8, pp. 443–454, 7 figs., 1942.

Inoculation experiments described in this paper were designed to test the hypothesis, referred to as the 'viroplasm hypothesis', that some part of the normal protoplasm of one species of plant, introduced into the cells of another, might find conditions compatible for growth and cause the abnormality known as virus disease [*R.A.M.*, v, p. 120]. The results obtained are stated to have yielded no positive proof in support of this hypothesis, but have suggested new lines of research and revealed the existence of two hitherto undescribed viruses.

When extracts from healthy plants of 122 species of legumes representing 50 genera were transmitted by the wiping method of inoculation to bean [*Phaseolus vulgaris*] and certain other test plants, 119 developed no symptoms. Of the remaining three, *Lathyrus tingitanus* regularly produced symptoms which are, however, believed to be an allergic response, and *L. pusillus* and *Sesbania macrocarpa* each yielded a new virus, here described for the first time under the common names of 'bean leaf wilt virus' and 'bean yellow necrosis virus', respectively. The symptoms produced by the former on Refugee bean are largely limited to the primary inoculated leaves, which usually wilt and dry up without developing necrotic lesions. The virus is transmissible by *Myzus persicae*; its thermal death point is 48° to 50° C. at 10 minutes' exposure; it tolerates ageing *in vitro* for 24 hours and in dried leaves for 30 days and withstands a dilution of over 1 to 1,000. The second virus described was secured in two separate trials, but not in several others; it causes marked yellowing and necrosis on Refugee bean. Other susceptible species are soy-bean and garden pea (Marvel variety). The virus is not transmissible by *M. persicae*; its thermal death point is 49° at 10 minutes' exposure, it survives ageing *in vitro* for 48 hours and possibly longer and in dried leaves for 12 days or more; it tolerates a dilution of 1 to 100,000 and possibly 1 to 500,000; it was removed from filtrates by both Mandler and Seitz filters and was not inactivated by cow's milk. It is presumed that these two viruses pre-existed in the hosts and did not originate as a result of the transfer of healthy protoplasm to another species.

HOW (MISS J. E.). **The mycorrhizal relations of Larch. II. The role of the Larch root in the nutrition of Boletus elegans Schum. III. Mycorrhiza formation in nature.**—*Ann. Bot., Lond.*, N.S., v, 17, pp. 121–131, 1 pl., 1941; vi, 21, pp. 103–129, 1 pl., 1 fig., 2 graphs, 1942.

In further studies of mycorrhizal formation in larch [*R.A.M.*, xix, p. 297] reported in the second paper of this series, the part played by larch roots as a nutrient source for *Boletus elegans* was investigated by adding excised root tips of conifer seedlings to pure cultures of the fungus. It was found that a growth-promoting substance or a substance complex was present in the primary roots of European and Japanese larch, but not in those of Scots pine. It was demonstrated that the main constituents of the growth promoter are soluble in water, but no further information on its nature could be gained. Microscopic examination of root-fungus cultures revealed a semi-parasitic invasion of the roots by the fungus, which appeared to have penetrated into the root cells by means of pressure from the growing mycelium.

The main body of the third paper is devoted to the formation of mycorrhiza in nature, while in an appendix an unsuccessful attempt to induce mycorrhiza formation with cultures of *B. elegans* and *Paxillus involutus* is described.

Measurements of roots of European larch showed that there are two distinct types, sublateral or short ones which normally form mycorrhiza, and lateral or long ones

which are infected very occasionally and then develop atypical mycorrhiza. Detailed descriptions are given of the structural features of mycorrhizal infections with seven fungi most commonly associated with the roots of larch, namely, *B. elegans*, *P. involutus* (both isolated from true mycorrhiza), *Mycelium radicis atrovirens* (isolated from pseudo-mycorrhiza), *B.* (?) *viscidus*, a yellow hymenomycete mycelium, and two unidentified mycelia. Sublateral roots infected with *B. elegans* (and the same is believed to apply to all true mycorrhiza-forming fungi) were found to show an increased number of cells in the cortex, the cells becoming oblong probably as a result of cell division. The following structural features are believed to be typical of a 'balanced' mycorrhizal association in larch. The mantle, varying in width from 10 to 70 $\mu$, consists of hyphae closely woven together in a manner characteristic of the fungus concerned. It encloses two or three layers of dead cortical cells, within which is a single layer of mainly squarish tannin cells with a few granular cells. The Hartig net extends across the outer cortex to the inner cortex and the cell walls are not swollen and contain only one strand of hyphae. The oblong outer cortical cells number at least 60. Intracellular infection is absent. Deviations from this structure are clearly due to the growth of the fungus at the root's expense and comprise very wide fungal mantles containing isolated cortical cells, very swollen cortical walls with two or more strands of hyphae and intracellular infection. Occasionally the reverse obtains and the fungus finds difficulty in establishing itself, as shown by the almost complete absence of the mantle and Hartig net. Under natural conditions, a sublateral root may remain uninfected (an infrequent occurrence) and unbranched, be infected by *B. elegans* or other mycelia to form a balanced association, form an unbalanced association with one of the mycorrhizal fungi, or be attacked by certain 'black' fungi which tend to form only pseudo-mycorrhiza.

Fries (N.). **Einspormyzelien einiger Basidiomyceten als Mykorrhizabildner von Kiefer und Fichte.** [Monospore mycelia of some Basidiomycetes as mycorrhiza-formers on Pine and Spruce.]—*Svensk bot. Tidskr.*, xxxvi, 2–3, pp. 151–156, 2 figs., 1942.

At the Institute for Physiological Botany, Upsala, in 1940–1, the author conducted synthetic experiments, substantially on the lines adopted by Melin in similar studies [*R.A.M.*, iii, pp. 358, 540; xviii, p. 541], with monospore mycelia. Four mycorrhiza-forming Basidiomycetes, viz., *Tricholoma pessundatum* [ibid., xviii, p. 542], *Boletus granulatus*, *B. luteus* [ibid., xviii, p. 406], and *Scleroderma aurantium*, were grown in flasks containing an acid nutrient solution (potassium dihydrogen phosphate) in contact with pine seedlings and the first- and last-named also with spruce, a total of 80 cultures being maintained. A parallel series of tissue cultures of one- to two-year-old mycelia of the same organisms was also run. At the conclusion of the test, after a period ranging from three to nearly five months for the several species, *T. pessundatum* was found to have produced an abundance of hyphae on the collar of the lateral roots. Mycorrhiza were more numerous on the pine than on the spruce seedlings, and were usually unbranched. The hyphae of *B. granulatus* made luxuriant growth, numerous mycorrhiza being formed on the pine roots, mostly in the form of single, occasionally in that of double forks. *B. luteus* did not develop so profusely as the foregoing, but two of the monospore mycelia gave rise to distinctly furcate mycorrhiza in all eight flasks containing pine seedlings. Hyphal growth in the case of *S. aurantium* was sparse, but each of the three monospore mycelia formed mycorrhiza on pine in at least one flask, only one, however, being similarly active on spruce (in two flasks). The mycorrhiza produced vigorous, white hyphal strands. Hyphal mantles, Hartig's network, and other typical anatomical features were observed in the mycorrhiza of all four fungi. None of the organisms was investigated in relation to its sexuality, but it is almost certain that the monospore mycelia of *S. aurantium* are haploid.

Melin (E.) & Norkrans (Birgitta). **Über den Einfluss der Pyrimidin- und der Thiazolkomponente des Aneurins auf das Wachstum von Wurzelpilzen.** [On the influence of the pyrimidin and thiazol components of aneurin on the growth of root fungi.]—*Svensk bot. Tidskr.*, xxxvi, 2–3, pp. 271–286, 4 graphs, 1942.

In further studies on the auxin requirements of mycorrhizal fungi [*R.A.M.*, xviii, p. 542], aneurin was shown to be replaceable by its pyrimidin and thiazol components in equimolar quantities in synthetic cultures of *Paxillus prunulus*, *Amanita pantherina*, *Tricholoma albobrunneum*, *Boletus granulatus*, and *B. variegatus*. Thiazol alone stimulates the growth of *B. luteus* and *B. piperatus*, though not so actively as in conjunction with pyrimidin, while the latter may be substituted for aneurin in the case of *Cenococcum graniforme*. The development of *Mycelium radicis atrovirens* [ibid., xviii, p. 700], which is aneurin-autotrophic, is retarded by the addition to the medium of aneurin or its components, especially pyrimidin alone or mixed with thiazol.

Savile (D. B. O.). **Alteration of Potato starch grain structure under the influence of disease.**—*Amer. J. Bot.*, xxix, 4, pp. 286–287, 6 figs., 1942.

Malformed starch grains, presumably resulting from an abnormal function of the leucoplasts, were found in 1939 in potato tubers affected by various fungus pathogens (including *Phytophthora infestans*), virus diseases, and environmental disorders. They were particularly abundant in tubers examined at harvest time and scarcer in those stored for the following winter. These grains are not eroded by hydrolysis. The leucoplast appears to become increasingly degenerate during the formation of the grain, as the hilum can be found close to the more normal end. The leucoplasm eventually ruptures on the thin side of the grain and then withdraws to the opposite side. The subsequent starch deposition takes the form of caps or segments, one upon another, giving the grain a larva-like appearance. Abnormal nuclear division, not connected with phellogen formation, was also observed, three, four, or even five nuclei being often seen in a single cell.

Iverson (V. E.) & Harrington (F. M.). **Accuracy of the ultra-violet-light method for selecting ring rot free Potato seed stocks.**—*Amer. Potato J.*, xix, 4, pp. 71–74, 1942.

The results of greenhouse tests conducted in 1941 at the Montana Agricultural Experiment Station to compare the accuracy of the ultra-violet light and Gram stain methods for the selection of Netted Gem potato seed stocks free from bacterial ring rot [*Corynebacterium sepedonicum*: *R.A.M.*, xxi, p. 263] showed the former to be equally effective with the latter and to be carried out in less than one-tenth of the time required for the stain, while a further advantage of the ultra-violet light was its elimination of tubers showing brown vascular discoloration.

[Beeley (F.).] **Pests and diseases.**—[*Abridged*] *Rep. Rubb. Res. Inst. Malaya, 1940*, pp. 10–12, 1941.

The results obtained [by R. P. N. Napper] in 1940 on the control of *Hevea* rubber root disease (*Fomes lignosus*, [*F. noxius*, and *Ganoderma pseudoferreum*]) necessitate the modification of some of the practical recommendations previously made in connexion with replanting [*R.A.M.*, xx, p. 34]. For instance, it is unnecessary to dig over the open central areas of infected patches in the old stand, the removal of the roots of trees known to be diseased sufficing, except where replanting is expected to be deferred for a considerable period, in which case annular zones at least 25 ft. wide must be thoroughly cleaned up round the margins to obviate the reinfection of the surrounding mature trees. Small patches not destined for replanting should be completely dug over.

For controlling root disease in areas showing no evidence thereof in the old stand,

poisoning by means of frill-girdling or stump injections [with sodium arsenite] is a cheap and effective method of clearing healthy trees where the incidence of *F. lignosus* after replanting is known to be low, and may appropriately replace felling in sites on steeply sloping ground, where soil disturbance must be reduced to a minimum. The most economical procedure of allowing the frill-girdled trees to decay *in situ*, thereby prolonging the tapping period up to or even beyond the time of replanting, involves a risk to human life from the falling crowns which cannot be disregarded. A prevalent misconception with regard to the poisoning treatment should be corrected: it does not destroy the agent of root disease in the infected roots, but kills the healthy living ones whereby the pathogen is spread.

Sun scorch of the tapping panel was unusually widespread in consequence of the abnormal drought, and palm oil was tested as a palliative with promising results. The incidence of pink disease [*Corticium salmonicolor*] was fairly high in some districts during the wet season, but mildew (*Oidium*) [*heveae*] was conspicuous by its virtual absence owing to the ideal wintering and refoliation conditions prevailing in the early part of the year.

HOERNER (G. R.). **A convenient scale for use in the rapid determination of comparative degrees of infection of Hops by the downy mildew fungus, Pseudoperonospora humuli.**—*Phytopathology*, xxxii, 4, pp. 331–333, 2 figs., 1 diag., 1942.

Excised hop leaves are placed on moistened disks of filter paper in the bottoms of Petri dishes and the exposed lower surfaces atomized with distilled water suspensions of the downy mildew fungus, *Pseudoperonospora humuli*. The moist chambers thus prepared are transferred to an incubation cabinet, in which the optimum germination temperature of 65° F. is maintained, for an appropriate period, after which clumps of sporangiophores bearing dark-coloured sporangia appear on the foliage of a susceptible host, such as the Late Clusters hop variety. The scale devised for the rapid determination of comparative degrees of infection consisted of traced outlines of a hop leaf of convenient size to fit into the Petri dish, each containing a given number of dots, from 0 to 100, to represent points of infection, the incidence of which is shown by a graduated range of numerals from 0 to 100.

TUNSTALL (A. C.). **Red rust.**—*Mem. Tocklai Exp. Sta. Indian Tea Ass.*, 14, 19 pp., 5 pl. (3 col.), 1942.

The last comprehensive discussion on red rust of tea (*Cephaleuros parasiticus*) published by the Indian Tea Association was the revised edition of Mann and Hutchinson's paper on the subject (1904). The writer well remembers, 25 or 30 years ago, the serious depredations caused by the blight, frequently involving losses of 10 to 15 per cent. of the crop, but the gradual recognition of the requirements of the host and the consequent improvement in cultural operations reduced the incidence of the disease in north-east India to a minimum until the recent introduction of restriction brought about the replanting of extensive areas of impoverished soil. Now that the parasite has again become prevalent under these unfavourable conditions, it was considered advisable to present this new account of the disease and recommendations for its control, the latter problem resolving itself into the maintenance of the host in a resistant state, since the total elimination of such a widespread organism as the alga under discussion is impracticable.

Although lack of soil moisture, combined with other adverse factors, such as poor aeration, undue reduction in leaf area, and excessive alkalinity, is the predisposing cause of susceptibility to red rust, spraying with 1 per cent. Burgundy mixture plus a rosin adhesive or 0·25 per cent. perenox (4 oz. per 10 gals.) proved to be a useful palliative in experiments at Borbhetta in the summer of 1938, while in 1940 perenox exerted a beneficial effect (still persisting nearly a year later) when applied in early

June at a concentration as low as 0·125 per cent. (2 oz. per 10 gals.). Light-leafed tea appears to be more susceptible to infection by *C. parasiticus* than dark-leafed.

Discussing the taxonomy of the agent of red rust, the writer prefers the name *C. parasiticus* Karst. to those of *C. mycoidea* Karst. or *C. virescens* Kunze, the last being singularly inapt since the pathogen imparts a red tinge to the foliage in place of its normal green. No significant difference was observed between the fructifications of the parasitic and purely epiphytic forms of the alga, but *C. parasiticus* is obviously a more appropriate name for the agent of the tea disease than *C. mycoidea*. Another unhappy misnomer is the common name of 'red rust', suggesting as it does a non-existent resemblance to wheat rust. The coloured plates are a feature of the paper.

Spencer (E. L.). **Specific biological activity of Tobacco-mosaic virus as influenced by age of lesion and nitrogen supply.**—*Plant Physiol.*, xvii, 2, pp. 210–222, 2 graphs, 1942.

A partial summary of the results of the writer's experiments on the relation of the nitrogen supply to the multiplication of the tobacco mosaic virus in the inoculated leaf has already been published [*R.A.M.*, xxi, p. 50]. In further studies, calculations from sedimentation rates in the analytical ultracentrifuge indicated that virus preparations from young lesions (five days after inoculation) may contain some particles (about one-third of the total) nearly double the length of the one component detected in 20-day-old lesions, which was also present in the young material. The second component under observation appears to be distinct from that observed by Wyckoff [ibid., xvi, p. 207], the development of which was attributed to protracted contact in storage with the buffer salts used as a solvent.

Loring (H. S.). **The reversible inactivation of Tobacco mosaic virus by crystalline ribonuclease.**—*J. gen. Physiol.*, xxv, 3, pp. 497–505, 1 fig., 1 graph, 1942.

Experiments showed that a ribonuclease concentration of $1{\cdot}2\times10^{-9}$ gm. per ml. exerts little or no effect on the activity of tobacco mosaic virus concentration of $10^{-5}$ gm. per ml. A decrease in activity was registered with a concentration of $1{\cdot}2\times10^{-8}$ gm. ribonuclease per ml., but the effect was not pronounced until a concentration of $1{\cdot}2\times10^{-7}$ or $1{\cdot}2\times10^{-6}$ gm. per ml. was reached. It was concluded that the inactivation of the tobacco mosaic virus with ribonuclease is comparable to that found for other proteins with high isoelectric points, and is thought to be related to the formation of complexes between oppositely charged protein particles. The solubility in salt or slightly acid or alkaline solutions suggests either partial or complete dissociation under these conditions.

Glasstone (Violette F. C.). **Study of respiration in healthy and mosaic-infected Tobacco plants.**—*Plant Physiol.*, xvii, 2, pp. 267–277, 2 figs., 3 graphs, 1942.

The writer describes the six-unit apparatus and the technique used in comparative studies at the Rockefeller Institute for Medical Research in the respiration rates of healthy and mosaic-diseased Samsun tobacco plants grown in a slightly modified formula of Hoagland and Arnon's nutrient solution (*Circ. Calif. agric. Exp. Sta.* 347, 1939) from the time of inoculation until the appearance of the mottling symptoms, an average period of a fortnight. The respiration ratio of diseased and healthy plants remained at the same level until vein-clearing became noticeable, after which the velocity of respiration of the inoculated plants rose rapidly until it exceeded that of the sound ones by 50 per cent., and then sank to a level about equal to that of the latter series by the time mottling became apparent. The intensified rate of respiration coinciding with the establishment of systemic infection in the diseased plants is considered to point to a corresponding increase in metabolic activity. The results obtained by the author and other investigators all indicate that the period of the clearing of the veins corresponds to the rapid movement and increase of the virus.

WELLMAN (F. L.). **Difference in $P_H$ relations of some pathogenically variable strains of Tomato Fusarium.**—*Phytopathology*, xxxii, 4, pp. 271–287, 2 graphs, 1942.

In further studies on the comparative virulence of different isolates (79 in all) of the tomato wilt fungus (*Fusarium bulbigenum* var. *lycopersici*) [*R.A.M.*, xx, p. 236], adjudged by the reactions to inoculation of Bonny Best and Marglobe, a highly pathogenic strain produced its maximum weight in a liquid medium (Tochinai's formula) [ibid., xix, p. 170] in 12 days, while nearly twice this period was required by a mild isolate. In the liquid medium the former out-yielded the latter, whereas on a new differential agar substratum [the composition of which is indicated] the mild isolate covered a larger area. The optimum hydrogen-ion reactions for the development of the strongly and weakly pathogenic strains on the liquid medium were $P_H$ 4·0 and 8·0, respectively, while on agar both grew best at a point slightly above neutral [ibid., ii, p. 347]. In a series of liquid media with a wide range of hydrogen-ion concentrations, cultures inoculated either with a mixture of mild and virulent strains or of actively saltating, unstable ones produced maxima at two different points. Under parallel conditions, the virulent and mild strains tended to induce alkaline and acid reactions, respectively, while those of intermediate pathogenicity produced results between these extremes.

TUCKER (C. M.). **The development of wilt resistant Tomatoes.**—*Proc. Mo. Acad. Sci.*, vii, 4, pp. 90–91, 1942.

Tomato wilt (*Fusarium* [*bulbigenum* var.] *lycopersici*) is widely distributed and destructive, especially in home gardens, in the latitude of Missouri and southwards. Of all the strains of *Lycopersicum esculentum* and *L. pimpinellifolium* tested for their reaction to the pathogen since 1933, only one, a Peruvian strain of the latter species, accession 160 of the United States Department of Agriculture, has remained free from infection during seven seasons under conditions inducing almost complete susceptibility in the commercial varieties. Crosses between the new strain and certain standard varieties resulted in $F_1$ hybrids with the resistance of *L. pimpinellifolium*, which was shown by the reactions of $F_2$ and back-cross progenies to be determined by a single genetic factor. Progenies of five generations of back-crossing to susceptible varieties have continued to segregate in the anticipated 1 resistant : 1 susceptible ratio, indicating that the resistance factor retains its potency unimpaired by association with numerous factors from the susceptible parent.

Three or more back-cross generations are usually necessary to secure plant and fruit characters approximating to those of superior commercial varieties, and three or more selfed generations are requisite for sufficient homozygosity to insure fairly uniform offspring, objects that have not yet been fully attained.

EATON (F. M.). **Toxicity and accumulation of chloride and sulfate salts in plants.**—*J. agric. Res.*, lxiv, 7, pp. 357–399, 5 figs., 4 graphs, 1942.

The results are given of experiments begun in 1934, in which the toxicity of chloride and sulphate salts to plant tissue was studied on a number of crops grown in large, outdoor, sand-culture beds. Blossom-end rot of tomatoes was found to develop in beds to which 50 or 150 milliequivalents of chloride per l. or 50, 150, and 250 of sulphate (affecting 7, 34, 2, 78, and 84 per cent. of plants, respectively) were added, while none occurred in the control plots. It is believed that neither unfavourable osmotic relations between the plants and solutions nor the accumulation of potassium or sodium can be regarded as a direct cause of the blossom-end rot induced by the treatments, but that calcium and magnesium accumulation singly or combined are important contributing factors.

Howard (F. L.). **The bleeding canker disease of hardwoods and possibilities of control.**—Reprinted from *Proc. eighth W. Shade Tree Conf.*, viii, 10 pp., 3 figs., 1941.

In addition to maples, already reported as hosts of *Phytophthora cactorum*, the agent of bleeding canker in Rhode Island and Massachusetts [*R.A.M.*, xix, p. 570], various species of beech, birch, elm, and oak have been found to suffer from the disease, the range of which is stated to extend from Maine to Florida and from Cape Cod to southern California. The symptoms of infection [loc. cit.] are similar in all the susceptible hardwoods. In preliminary tests of malachite green, helione orange, and other organic chemicals against the fungus, instead of adding the diluted chemical to the culture on wooden blocks, a more satisfactory result was obtained when the chemical was absorbed by a living tree, the tree cut down, and blocks from this dyed wood inoculated with *P. cactorum*. The fungus covered the unstained portions in seven days but stopped at the stained tissue. With the aid of a simple injection technique, whereby solutions can be taken up by the vascular tissues without the interference of air bubbles plugging the severed ends of xylem vessels, infiltration with 1 in 200 helione orange [cf. ibid., xiv, p. 590], a form of the di-hydro chloride salt of di-amino-azobenzene combined with an emulsifying agent in dilute acetic acid emulsion, was carried out in 1939 and 1940 on 338 maple and 13 beech trees, 299 (85·1 per cent.) of which made a complete recovery, judged by failure to reisolate the pathogen from the treated tissues. The fungus produces a toxic substance which was neutralized in experiments by helione orange at a strength of 1 in 500.

Bonar (Lee). **Studies on some California fungi. II.**—*Mycologia*, xxxiv, 2, pp. 180–192, 2 figs., 1942.

This annotated list of 19 fungi from California [cf. *R.A.M.*, xx, p. 323] contains the following new species of interest. *Mycosphaerella sequoiae* on leaves and young twigs of *Sequoia sempervirens* is described as having numerous perithecia, hypophyllous, rarely epiphyllous, scattered, single or clustered, subepidermal, globose, erumpent, 90 to 125 $\mu$ in diameter; fasciculate asci, elongate-cylindrical, slightly narrowed above, short-stipitate, 8-spored, 50 to 60 by 10 to 12 $\mu$; fusiform-elliptical, hyaline, bicellular ascospores, 11 to 14 by 3 to 4 $\mu$; and no paraphyses. The fungus infects the tips of the leaves and works back to the base, a high percentage of the leaves being killed and the foliage presenting a blasted appearance. *Diedickea piceae* on leaves of *Picea sitchensis* causes yellowing and discoloration with early leaf fall. It appears on the current season's foliage in the autumn, becoming conspicuous the following summer. The pycnidia separate from the yellowed leaf and fall off. They are amphigenous, scattered or crowded, entirely superficial, borne on a very thin subiculum of a meshwork of fine, hyaline hyphae with occasional larger brown ones, disciform, radiate, non-ostiolate, and 200 to 400 $\mu$ in diameter, and contain elliptical, hyaline, unicellular conidia, 2·5 to 3·5 by 1 $\mu$, without conidiophores. *Dothichiza garryae* was found on living or dead leaves of *Garrya elliptica* and *G. flavescens* var. *buxifolia*. *Phyllosticta phoradendri* forms brown spots on leaves of *Phoradendron flavescens* var. *macrophyllum* on *Populus* sp., with pycnidia 125 to 200 $\mu$ in diameter and conidia 2 to 3·5 by 1 $\mu$; it causes a conspicuous killing of the leaves.

A study of three fungi found growing on dead twigs of *Ilex aquifolium* showed that single-spore cultures of two of them, *Physalospora ilicis* and *Macrophoma ilicella*, were indistinguishable when grown under similar conditions; the latter is, therefore, considered to be a stage of the former fungus. Single-spore cultures of the third fungus, *Phoma ilicina*, differed from the first two in appearance and growth, and it is concluded that this fungus is distinct.

*Polyporus sulphureus* is reported to cause an extensive heart rot of the lower trunk and large roots of living *Eucalyptus globulus* in central California; one three-tiered sporophore of the fungus, 12 by 18 in. and 8 lb. in weight when fresh, was observed

to mature within 15 days after emergence. *Trochilia ilicis* (Chev.) Crouan, apparently uncommon in America, was collected on diseased or dead leaves of *Ilex aquifolium*.

Pomerleau (R.). **The spherical gall rust of Jack Pine.**—*Mycologia*, xxxiv, 2, pp. 120–122, 1 fig., 1942.

In addition to the two well-known types of gall rusts on Jack pine (*Pinus banksiana*), namely, the fusiform gall caused by *Cronartium comandrae* [*R.A.M.*, xviii, p. 73] and the effused gall of the base of the stem caused by *C. comptoniae* [ibid., xx, p. 614], a third type, a true globose gall, has been observed for several years in Quebec. Some galls of this type are considered to be related to those of *C. quercuum*, but not all, for they occur in northern regions, where oak, the alternate host, is from 200 to 300 miles distant; others appear more closely to resemble those due to *C. coleosporioides*. The teleuto stage of the latter rust was recently collected on *Melampyrum lineare*, and previously on other hosts. Pending definite proof of the relation between the rust on *M. lineare* and the spherical gall on Jack pine by direct inoculation, the author tentatively proposes the extension of the range of *C. coleosporioides* to eastern America and the addition of *P. banksiana* to its list of aecidial hosts.

Davidson (R. W.), Campbell (W. A.), & Weber (G. F.). **Ptychogaster cubensis, a wood-decaying fungus of southern Oaks and Waxmyrtle.**—*Mycologia*, xxxiv, 2, pp. 142–153, 3 figs., 1942.

A fungus, tentatively identified as *Ptychogaster cubensis* on the basis of comparison with numerous herbarium specimens, was isolated from decaying heartwood in *Quercus phellos*, *Q. nigra*, and *Q. catesbaei* and from central decay in living stems of waxmyrtle (*Myrica cerifera*), the first-named from Louisiana and the others from Florida. The conidial stage of the fungus was collected on dead trunks of *Q. catesbaei*, *Q. nigra*, and *M. cerifera*, and at branch stubs and injuries on living trunks of *M. cerifera* and *Q. virginiana geminata*. The herbarium specimens examined were from Brazil, Peru, Hawaii, India, Haiti, and the Bahamas, but until comparison of cultures from various hosts in the above localities are made, it will remain doubtful whether they represent one or several species. Those from Peru and the Bahamas contained what appeared to be a few basidiospores, indicating that the *P. cubensis* type of fungus has a basidial stage in the genus *Polyporus*.

Attempts to germinate conidia of *Ptychogaster cubensis* in culture were unsuccessful. The fungus grew well at 30° C., but was inhibited at 10° and 40°. On 2 per cent. malt agar, mats 2·5 to 5 cm. in diameter were formed after 14 days at room temperature; at first they were white, moderately raised, and loose cottony, but later became darker at the centre with a narrow or wide, white margin. When illumination was weak the cultures remained almost white. Setal hyphae were formed in abundance, visible to the naked eye as fine brown streaks. Staining hyphae were thin-walled, 1 to 5 $\mu$ in diameter, with cross walls but without clamps; non-staining, yellowish ones were found in the brown portions of the mats in connexion with conidial formation. Conidia were abundant, often formed in chains, globose, ovoid or irregular, and measuring 5 to 10 $\mu$ in diameter.

Davidson (R. W.), Campbell (W. A.), & Vaughn (Dorothy B.). **Fungi causing decay of living Oaks in the eastern United States and their cultural identification.**—*Tech. Bull. U.S. Dep. Agric.* 785, 65 pp., 3 pl., 4 figs., 1 diag., 1942.

The authors secured many isolates of oak heart-rotting fungi from various localities in the central, eastern, and southern States of the American Union and identified all the more important organisms by their cultural characters [cf. *R.A.M.*, xvii, p. 423; xviii, p. 360], in which connexion an account is given of the classification and file

system developed by the Division of Forest Pathology for purposes of reference and comparison. The first column of the index cards used for the transcription of the pertinent data is concerned with such obvious cultural aspects of a given fungus (*Polyporus hispidus* [ibid., xvii, p. 83] being cited as an example and the card describing it figured) as colour of the mycelial mat and growth rate on malt agar, while the oxidase reaction is included for the separation of white from brown rot fungi. At the top of the second column are listed such features as the texture of the mat and type of margin, the variability of which, however, precludes their use in the formulation of the key pattern. The lower part of the second and the whole of the third column are reserved for notes on the microscopic characters of the fungus, the more important being sketched in the space provided in columns four and five, which also contain information as to the origin of the culture and test-tube data, taken preferably at 28 days. A line is left at the bottom of the card for remarks on distinguishing characteristics—colour and the presence of setal hyphae in the case of *P. hispidus*—while a Petri dish photograph of the fungus taken at 14 days is pasted on the back. The file pattern at the top of the card expresses the macroscopic and microscopic features of the pathogen, the former being represented by letters and the latter by numbers, with the following formula for *P. hispidus*: C (yellow)—P (positive for oxidase—white rot)—M (medium growth rate, 5 to 9 cm. in 14 days at 26° C.)—7 (setae)—11 (non-staining hyphae). Based on this system, a key has been drawn up for the 50 oak-rotting fungi investigated along these lines.

In the eastern States, *Stereum gausapatum* was the predominant agent of butt rot in young stands [ibid., xiv, p. 663], parent stumps providing the main source of infection, while other species often encountered were *Armillaria mellea*, *Fistulina hepatica* [ibid., xvii, p. 277], and *S. frustulosum* [ibid., xix, p. 246]. The last-named and *Hydnum erinaceus* [loc. cit.] apparently enter the trees of older stands in the central and eastern States through fire wounds in the base or upper part of the trunk or large branches near the top. Other important trunk- or top-inhabiting species in the central States were *Poria andersonii* [ibid., xix, p. 374] and *Polyporus dryophilus* [ibid., ix, p. 749], while *P. compactus* [ibid., xvi, p. 505], *P. sulphureus*, and *Poria cocos* [ibid., viii, p. 813; xix, p. 246] were also commonly isolated in these areas and the east. In the Mississippi Delta region oak heart rots were mostly caused by species absent from the other localities comprised in the survey, young fire-wounded stands being invaded by *Fomes geotropus* [ibid., xv, pp. 471, 759], *Lentinus tigrinus* [ibid., xviii, p. 559], *Corticium lividum* [ibid., xix, p. 246], and *Polyporus lucidus* [*Ganoderma lucidum*], the last-named, with *F. geotropus*, being the predominant species among older fire-damaged trees, which also harboured *P. zonalis* [loc. cit.], *P. fissilis*, *P. ludovicianus*, and *Poria inflata*. Of the 1,718 classified oak decay infections procured from all the areas sampled, 707 were caused by *S. gausapatum*, 135 by *H. erinaceus*, 96 by *A. mellea*, 71 by *Fistulina hepatica*, 66 by *P. andersonii*, 55 by *Polyporus compactus*, 51 by *P. dryophilus*, 45 by *Poria cocos*, 42 by *Polyporus sulphureus*, 29 by *Fomes geotropus*, 27 by *C. lividum*, 27 by *P. spraguei* [ibid., xvi, p. 716], and 22 by *G. lucidum*, while each of the 34 rarer species accounted for one or more infections (up to 17): *F. everhartii* [ibid., xviii, p. 487], *F. applanatus* [*G. applanatum*], *F. robustus* [ibid., xvii, p. 358], and *P. hispidus*, commonly found forming fruit bodies on living oaks, were only isolated from seven, four, three, and six, respectively, of the samples examined.

Many of the heartwood specimens yielded only moulds or other non-rotting fungi, e.g., *Paecilomyces varioti* [*Penicillium divaricatum*: ibid., xix, p. 317], which was commonly isolated from brownish streaks widely removed from trunk or basal openings and from brown discolorations round insect tunnels; *Trichoderma lignorum* [*T. viride*: ibid., xvi, p. 575]; and the imperfect stage of (?) *Coryne sarcoides*, characterized by dark reddish-purple coremia bearing conidia in profusion.

Considerable damage was inflicted on the trees by the more prevalent wood-rotting fungi, but in general, the information on this point is not sufficiently accurate or

extensive to form a basis for further discussion. There was no marked tendency to preference for any particular host on the part of most of the fungi under observation, but *Fistulina hepatica* was usually obtained from scarlet oak [*Quercus coccinea*] and *Corticium lividum* almost exclusively from the overcup oak (*Q. lyrata*).

Smith (M. E.) & Bayliss (N. S.). **The necessity of zinc for Pinus radiata.**—*Plant Physiol.*, xvii, 2, pp. 303–310, 3 figs., 1942.

Seedlings of *Pinus radiata* grown at the University of Western Australia in nutrient solutions deprived of zinc by extraction with a chloroform solution of diphenylthiocarbazone (a method likewise applicable to the removal of copper) developed in the course of three or four months deficiency symptoms comprising a retarded growth rate with consequent flattening of the tops; inward folding of the apical needles, which later exhibit a yellow mottling, followed by bronzing; the production of short, stiff, dark green secondary needles in unopened fascicles; and swelling of the root tips. Attempts to induce mycorrhizal formation on the roots of the experimental plants were unsuccessful [cf. *R.A.M.*, xvi, p. 9], so that the role of these structures in relation to zinc deficiency, a common cause of disease in pines according to studies by S. L. Kessel and T. N. Stoate (*Aust. For.*, i, pp. 4–13, 1936; *Bull. W. Aust. For. Dep.* 50, 1938), could not be further investigated.

Baxter (D. V.). **Some resupinate Polypores from the region of the Great Lakes. XIII.**—*Pap. Mich. Acad. Sci.*, xxvii (*1941*), Part I, pp. 139–161, 11 pl., 4 maps, 1942.

Continuing his studies on the resupinate Polypores from the Great Lakes region of the United States [*R.A.M.*, xx, p. 388], the writer draws attention to the importance of *Trametes serialis* as an agent of decay in Sitka spruce (*Picea sitchensis*), a valuable source of timber for aeroplane construction, and other softwoods [ibid., xiv, p. 805; xx, p. 2; xxi, p. 110]. Specimens of the fungus have been collected from both the coastal and interior forests of Alaska, the Yukon Territory, and the Northwest Territories, as well as from other parts of Canada and a number of States of the American Union.

*T. serialis* may be differentiated from the related *T. heteromorpha* by its brown pileus, that of the latter being white, and smaller pore mouths, averaging 2 to 3, occasionally 4, to a mm. compared with 0·5 to 3 in *T. heteromorpha*. *T. morganii* on poplar and oak has repeatedly been mistaken for *T. serialis*, but in all probability most of the specimens labelled by the latter name on hardwoods are actually referable to the former, though birch (*Betula papyrifera*) is one of the hosts of the latter. A certain macroscopic similarity exists between resupinate specimens of *Fomes fraxinophilus* [ibid., xviii, p. 280] and those of *T. serialis*, but not only is the former confined to ash or buffalo berry [*Shepherdia argentea*], but its bracket-shaped or knob-like immature fructifications are usually found elsewhere on the tree, and, moreover, its ovoid spores measure only 6 to 7 by 5 to 6 $\mu$ compared with 6 to 10 (usually 7 to 9) by 2 to 3 $\mu$ for those of *T. serialis*. Confusion is also very liable to arise between *F. annosus* and *T. serialis* owing to their external resemblances and common hosts, but the ovoid spores of the former measure only 4 to 6 by 3 to 4 $\mu$.

Few lignicolous fungi are of such importance as agents of decay in both standing trees, notably redwood (*Sequoia sempervirens*) in California, and structural timber as *T. serialis*, the immense losses caused by *Lenzites sepiaria* and *Poria incrassata*, for instance, being restricted to felled wood. Decay in storage yards in the Northwest is also largely attributable to *T. serialis*, the ravages of which in shipments of timber become apparent at the place of destination. The fungus commonly gains ingress to standing redwoods through fire scars or 'goose pens', on the walls of which its fruit bodies may often be found; the cubical rotted sections of the invaded trunk in turn become highly inflammable and extensive cavities are burnt in them by subsequent

ground fires. The practice of burning a logged-over area to clear it of the debris incidental to felling and other operations is thus seen to be undesirable. Most of the rot appears to be concentrated in the first 20 ft. of the trunk, though infection may extend up to 36 ft. from the ground.

A diagnosis is given of *T. alaskana* n. sp., occurring in Yukon Territory, Alaska, British Columbia, northern California, Oregon, and Washington on *P. sitchensis*, *P. glauca*, and *Tsuga heterophylla*, accompanied by a discussion on its morphological and cultural characters with special reference to its separation from the allied species, *Trametes serialis*, *T. heteromorpha*, and *T. variiformis*. *T. alaskana* differs from *T. serialis* in its thick habit of growth, its discoloration on drying, and, in culture, its slower, thinner, and smoother growth with longer tubes.

HADDOW (W. R.) & NEWMAN (F. S.). **A disease of the Scots Pine (Pinus sylvestris L.) caused by the fungus Diplodia pinea Kickx associated with the Pine spittle-bug (Aphrophora parallela Say.). I. Symptoms and etiology.**—*Trans. roy. Canad. Inst.*, xxiv, 1, pp. 1–17, 1 pl., 1942.

In southern Ontario, *Diplodia pinea* [*R.A.M.*, xx, p. 340; xxi, p. 100] is endemic and ordinarily rare enough to be of little significance, but is capable of causing an epidemic tip blight of Scots pine planting stock in transplant lines, though this trouble, resulting from infection at or near the terminal bud cluster through unknown courts, has never become serious.

During the past few years, however, the fungus, in association with the pine spittle bug (*Aphrophora parallela*) has been responsible for a lethal, epidemic bark disease of the twigs, branches, and stems of Scots pines, characterized by massive crown infection and close spread, and often causing the death of entire trees. Much of the foliage dies without becoming infected, owing to the death of the branches bearing it. The needles turn rusty-brown and are retained until winter, or later. When the current season's shoots are infected early, by spread of the fungus from below, they often become characteristically bent or curled, and usually die before maturing. When these shoots are infected near the distal end, late in the season, there is marked stimulation of budding just below the lesion. The disease is essentially one of the bark of the younger internodes of the branches and trunk. Small, local lesions, originating in stylet wounds, coalesce and become large lesions. When the internodes rapidly increase in diameter, the lesions assume a canker form, and slight surface irregularities develop. Resin exudes copiously from bark fissures and the base of short shoots. It causes conspicuous bluish-white streaks on the bark and sometimes collects in soft masses in the foliage. Short shoots on infected branches are invaded, and the leaves killed.

The development of the disease depends on association with the insect. When this becomes epidemic, the trees are conditioned for mass infection, which in turn leads to rapid increase in inoculum. The nymphs, enveloped in spittle, appear just below the expanding buds about the middle of May. They feed mostly on the shoots on which they are born, and the penetration of the feeding holes is often deep. When adults feed on young internodes, the cambium may be reached. Traumatic false rings are induced in the late wood. The insects thrive on healthy, vigorous trees.

The authors' studies lead them to conclude that *Phoma pinastri* Lév., *Diplodia conigena* Desm., and *Sphaeropsis ellisii* are synonymous with *Diplodia pinea*, which, for reasons of priority, should be retained. The spores ranged from 33 to 46 by 12 to 16 $\mu$. Newly matured pycnidia were found early in June, and throughout the summer, commencing to sporulate when wetted, i.e., in rainy weather, and when the bark was wetted by the dripping spittle.

In inoculation tests, typical crown blight resulted when a concentrated spore suspension of the fungus was applied to a branch infested by the insects, on a tree growing in a locality where the disease had not previously been observed.

**Forest Research in India and Burma, 1940–41. Part I. The Forest Research Institute.** —161 pp., 1941.

K. D. Bagchee, in this report (pp. 105–107), states that the study of wood-rotting fungi was given precedence over all other investigations. Data on the loss of sal [*Shorea robusta*] sapwood from infection by *Fomes lignosus*, *Polystictus sanguineus* [*R.A.M.*, xvii, p. 88], *Schizophyllum commune*, *Stereum hirsutum* and various Polypores, and by *Lenzites sepiaria* and *P. versicolor* on chir [*Pinus longifolia*] were tabulated for future reference. Ascu [ibid., xix, p. 504] effectively inhibited the growth of *Polystictus sanguineus* on *Shorea robusta* sapwood blocks at concentrations of 4, 6, and 8 per cent.

Narayanamurti (D.) & Ranganathan (V.). **Studies on coal tar creosote as a wood preservative. Part I. Creosote extracted from timbers in service.**—*For. Bull. Dehra Dun*, N.S., 104, Util., 18 pp., 1 diag., 1941 (issued 1942).

A tabulated account is given of recent analyses of creosotes extracted from old hard- and softwood railway sleepers that had been in service for varying periods on Indian railways, and some sal (*Shorea robusta*) fence posts treated and set up at the Forest Research Institute, Dehra Dun [cf. *R.A.M.*, xix, p. 632]. Variations were detected in the composition of the creosotes extracted from different sleepers, and even from different positions of the same sleeper, while the specific gravity of the oil extracted was generally higher in the outer sections, the oil in which also contained higher residues than the inner layers [cf. ibid., xvii, p. 4]. Tar acids were not entirely leached out even after lengthy periods of service, 4 per cent. being present, for instance, in *Schina wallichii* sleepers after 14 years; the average life of this species is estimated at 26 years. Leaching was more extensive at the bottom of a sleeper, whereas the top and outer layers underwent greater evaporation and oxidative changes. In the fence posts the specific gravity of the creosote tended to increase with height, concurrently with a significant drop in the concentration of the fungicide. After 24 years on the track, the *Dipterocarpus macrocarpus* sleepers were still sound, but less satisfactory results were obtained with fir (*Abies pindrow*), especially those treated by the Rueping process, in which penetration was shallow.

Hildebrand (A. A.) & Koch (L. W.). **Savoy disease of Sugar Beets in southwestern Ontario.**—*Phytopathology*, xxxii, 4, pp. 328–331, 1 fig., 1 diag., 1942.

Attention is drawn to the occurrence on sugar beets in southwestern Ontario of the 'savoy' disease previously reported by Coons and his collaborators from the United States, where transmission was effected by the pigweed bug *Piesma cinerea* [*R.A.M.*, xvi, p. 510]. This insect has also been reported from Ontario by Stirrett (*Sci. Agric.*, xvi, pp. 180–196, 1935) and circumstantial evidence points to the conveyance of the virus to the beets from weeds, among which were *Ambrosia artemisiifolia*, (wild) carrot, *Solidago canadensis*, *Chenopodium album*, white clover (*Trifolium repens*), and *Amaranthus* spp. In one of the fields inspected, 245 out of 11,200 plants (2·1 per cent.) were found to be 'savoyed', the maximum incidence of 6·5 per cent. in a single row being registered in those portions nearest to the weeds.

Leach (L. D.) & Davey (A. E.). **Reducing southern Sclerotium rot of Sugar Beets with nitrogenous fertilizers.**—*J. agric. Res.*, lxiv, 1, pp. 1–18, 2 figs., 3 graphs, 1942.

In field experiments conducted from 1934 to 1937 in the Sacramento Valley, California, the application of nitrogenous fertilizers gave a consistent reduction in the percentage infection of sugar beets by *Sclerotium rolfsii* [*R.A.M.*, xx, p. 618]. The average results from 13 trials showed that 50 lb. nitrogen per acre reduced infection by about 28 per cent., 100 lb. by 54 per cent., and 200 lb. by 65 per cent., compared with unfertilized areas. The results were equally good whether ammonium sulphate,

anhydrous ammonia, calcium nitrate, or cyanamide was used (in equivalent amounts) as the source of nitrogen, no significant differences being observed whether the fertilizer was broadcast in advance of planting, dissolved in the irrigation water, or applied as a side dressing to the growing crop. For satisfactory results the applications must be made before any large percentage of beets has been infected. In heavily infested, or in some cases even in lightly or moderately infested fields, the increases in yield are, however, stated to be too insignificant to warrant the application of nitrogenous fertilizers, and the economic use of this method of control is, therefore, limited to fields in which the increase in yield following treatment more than balances its cost.

Laboratory experiments showed that low concentrations of ammonia in aqueous solution are toxic to the mycelium and sclerotia of *S. rolfsii*; ammonium sulphate in alkaline solution was mildly toxic to the mycelium, while calcium nitrate in solutions of similar concentrations was harmless to the mycelium and sclerotia. Since these three materials gave equally good results in field trials, it is suggested that the control obtained may have been due to factors other than ammonium toxicity. Heavy applications of anhydrous ammonia and cyanamide to naturally infested soils failed to destroy the sclerotia or to reduce their viability, but the effects of these materials upon mycelium in the soil were not determined. As an explanation of the partial control obtained in these experiments by nitrogenous fertilizers, it is suggested that changes in the metabolism of the fungus may reduce its growth or pathogenicity; that resistance of the host plants may be increased by changes in its metabolism and anatomy; or that the fungus may be suppressed following a change in the balance of micro-organisms in the soil.

Dahlberg (H. W.), Maxson (A. C.), & Brewbaker (H. E.). **Breeding for resistance to leaf spot and other characters.**—*Proc. Amer. Soc. Sug. Beet Technol., 1940*, pp. 169–180, 1940. [Abs. in *Sugar*, xxxvii, 4, pp. 42–43, 1942.]

Among other objectives of the Great Western Sugar Company are the development of beet varieties resistant to curly top [*R.A.M.*, xxi, p. 316], blight or leaf spot [*Cercospora beticola*: ibid., xxi, p. 178] (which largely determines the choice of varieties in the three States of the American Union and one Canadian Province covered by the Company's operations, i.e., Michigan, Ohio, Indiana, and Ontario), and *Rhizoctonia* [*Corticium solani*: loc. cit.]. In this region the Great Western field variety may be used for 60 per cent. of the beet acreage, a leaf spot-resistant variety for 35 per cent., and a new one resistant to *C. solani* for 3 to 5 per cent. Several lines of approach are followed in breeding for leaf spot resistance, including intensive family and group breeding, mass selection, $F_1$ crosses, crosses of élite material with *B*[*eta*] *maritima* (North Sea types), and selection in self-fertilized lines. Some of the new strains combine resistance to leaf spot with winter-hardiness, and a gain of about 1·5 points in purity over foreign varieties has been accomplished.

Reinau (E. H.) & Macke (W.). **Wann ist Schwefel ein Vorbeugungsmittel gegen Herzfäule der Zuckerrübe?** [When is sulphur a prophylactic against heart rot of the Sugar Beet?]—*Angew. Bot.*, xxiii, 5, pp. 348–360, 1941.

The writers fully describe their laboratory and field trials at the Research Station for Soil Hygiene at Strassburg, Alsace, supplemented by experiments on a local farm, the results of which showed that the development of heart rot of sugar beets in over-limed and strongly alkaline soils may be counteracted by the application of sulphur in sufficient quantities to adjust the reaction to neutrality. In 1932, the percentages of healthy beets in plots supplied the previous year with 800 and 1,600 kg. per ha., respectively, were 90 and 97, respectively, compared with 80·76 for the untreated control plots and 94·05, 95·7, 98·6, 99·1, and 99·6 for those receiving 3, 5, 10, 20, and 40 kg. boric acid per ha., respectively, the results from the 1,600 kg. application being

thus intermediate between the 5 and 10 kg. boric acid treatments [*R.A.M.*, xviii, p. 428]. The constitution of the soil once having been improved by the judicious incorporation of small doses of sulphur, say 300 to 800 kg. per ha., it should be possible to maintain the boron balance by the reintroduction into the ground of the quantity of boric acid withdrawn by a sugar beet crop, i.e., 2 to 2·5 kg.

Roque (A.) & Adsuar (J.). **Studies on the mosaic of Peppers (Capsicum frutescens) in Puerto Rico.**—*J. Agric. P.R.*, xxv, 4, pp. 40–50, 4 figs., 1941.

Three years prior to the time of writing, a mosaic disease of [chilli] pepper (*Capsicum frutescens*) developed in epidemic form at the Agricultural Experiment Substation, Isabela, since when it has spread with great intensity to other parts of Puerto Rico [*R.A.M.*, xx, p. 564]. Serrano and Riollano (*in litt.*) estimated the crop losses due to the disease at Isabela in 1938 at 50 to 60 per cent. Symptoms of infection include a marked clearing of the veins in the younger leaves in about 10 to 12 days after inoculation, followed by systemic mottling, usually ending in veinbanding. In addition the leaves become wrinkled and the plant stunted, especially if infected early. Fruit-setting is reduced and the fruits that develop are undersized, mottled, and badly distorted. On the Large Bell Hot variety a systemic vein necrosis is produced in five or six days and is followed by defoliation, stem-streaking, and death, whilst mottling and veinbanding are absent.

The virus responsible for the disease is readily transmissible by mechanical methods and evidence was secured that the aphid *Myzus persicae* is also concerned in its conveyance from infected to healthy plants. It is inactivated by 48 hours' ageing *in vitro* and by exposure to a temperature of 55° to 58° C., while infectivity rapidly declines at dilutions of 1 in 80 and is virtually nil at 1 in 100. No immunological relationship could be established, by inoculation experiments on the Large Bell Hot variety, between the Puerto Rican chilli mosaic, the potato mottle and veinbanding viruses, or those of ordinary tobacco mosaic and cucumber mosaic.

Of 84 chilli varieties tested, only two showed any resistance to the virus. Inoculation experiments on Virginia tobacco, *Nicotiana glutinosa*, *N. bigelowii* vars. *multivalvis* and *quadrivalvis*, and *N. rustica* gave positive results. Occasional symptoms further developed on the Puerto Rican Beauty eggplant and the Marglobe tomato, but the presence of the virus was not substantiated by tests back to Large Bell Hot chilli.

The results of these studies appear to indicate that the virus under discussion is either a known form not hitherto reported as attacking chilli, or an as yet undescribed entity.

Kligman (A. M.). **Secondary spores in the mycelium of the cultivated Mushroom, Psalliota campestris Fr.**—*Amer. J. Bot.*, xxix, 4, pp. 304–308, 9 figs., 1942.

Chlamydospore-like bodies were consistently observed in old cultures of the brown and white varieties of the cultivated mushroom, *Psalliota campestris*. None were found in young cultures of the cultivated varieties or in any cultures of the wild, four-spored mushroom. The chlamydospores (the term is here used for transformed vegetative cells capable of giving rise to new mycelia) studied in old cultures of fertile races of the 'snow-white' variety, [R.A.M., xx. p. 621] are described as being rarely less than 8 $\mu$ in diameter or more than 25 $\mu$ in length (average 10 by 14 $\mu$), septate, ovoid, globose, rectangular, or elliptical, with many modifications of these shapes, and as a result of random septation, either terminal, intercalary, or most frequently in chains. Their cytoplasm is dense and loaded with granules; they are most abundant at and just below the surface of the agar. The chlamydospores formed by the sterile races of *P. campestris*, on the other hand, were rounder and more uniform in shape; their cytoplasm was not dense and contained no granules. In both the fertile and the sterile races, chlamydospores were found to be multinucleate. The twelve single-spore

isolations obtained from a fertile race presented no cytological or morphological differences, and mushrooms were grown from each of the cultures made from these spores.

WOODROOF (NAOMI C.). **Increased yields of Spanish Peanuts obtained by dusting.**—*Circ. Ga Exp. Sta.* 136, 4 pp., 1 fig., 1942.

The average increase per acre in the yields of Spanish groundnuts obtained at four localities in Georgia in 1941 by dusting for leaf spot [*Cercospora arachidicola* and *C. personata*] control [*R.A.M.*, xviii, p. 236; xxi, p. 126] with sulphur, copper-sulphur 10–90, copper-sulphur-clay 10–30–60, copper-wheat flour-clay 10–10–80 (the copper used being basic copper sulphate in each instance), and red copper oxide-clay 10–90 were 400·6, 463·6, 423·2, 254·2, and 444·1 lb., respectively. The average increase secured with sulphur dust over the five-year period 1937 to 1941 amounted to 326·4 lb. per acre. In 1941 two broadcast applications of a sulphur-gypsum mixture 1–3 resulted in an increase of 222·9 lb. per acre. It is recommended that dusting with sulphur (93 per cent. through a 325-mesh) or copper-sulphur 10–90 should be begun on the first appearance of the spots on the basal leaves (usually 60 to 65 days after planting or between 15th June and 1st July), three to four applications being given, ordinarily at fortnightly intervals, and 15 to 20 lb. per acre used. The cost of the sulphur used amounts to $3·00 to $3·50 per 100 lb.

NEDELTSCHEFF (N.) & KONDAREFF (M.). **Beobachtungen über die Behandlung von Weinreben gegen Peronospora. Bei der Behandlung von Weinreben mit Kupferlösungen auftretende Verbrennungen.** [Observations on the treatment of Vines against *Peronospora*. Scorching consequent on the treatment of Vines with copper solutions.]—*Annu. Univ. Sofia*, xviii, 1, pp. 51–80, 181–192, 1940. [Abs. in *Chem. Zbl.*, cxiii (i), 15, p. 1930, 1942.]

In comparative trials on the control of vine *Peronospora* [*Plasmopara viticola*] in Bulgaria with copper sulphate solutions of varying strengths from 0·2 to 2 per cent. and Casale's 0·2 per cent. colloid solution [*R.A.M.*, xvii, p. 12], the minimum toxic concentration for the standard preparation was 0·75 per cent. (a 1 per cent. solution is recommended for practical purposes) and no advantage was derived from the use of the colloid solution, since its lack of scorching tendency was outweighed by its poor fungicidal properties. The extent of the scorching caused by the standard solutions seemed to be virtually independent of their concentration, the lower dosages, in fact, often producing more severe injury than the higher ones, especially at an acid reaction, little damage occurring around $P_H$ 9·0, while the trouble was further mitigated by the addition to the mixture of linseed oil or resin.

BENLLOCH (M.). **Algunas características fitopatológicas del año 1941.** [Some phytopathological characteristics of the year 1941.]—*Bol. Pat. veg. Ent. agric., Madr.*, x, 29–32, pp. 1–14, 10 figs., 1941.

In contrast to the severity of the vine [downy] mildew [*Plasmopara viticola*] epidemic of 1940, the Mancha and the greater part of central Spain remained free from the disease in 1941, notwithstanding the rainy spring, the favourable effect of which on the pathogen was apparently counterbalanced by the adverse factors of wind, low temperature, and reduced vegetative activity of the host during May. In other viticultural centres with a more temperate climate infection became established at an early date and the damage was aggravated by the prevailing scarcity of available copper for spraying. In this connexion reference is made to recent experiments in Spain in the treatment of downy mildew by the Italian low-copper formulae [R.A.M., xx, p. 622; and preceding abstract] the action of which, however, cannot be altogether relied upon in a virulent epidemic. A saving in the copper consumption could no doubt be effected by the use of spreaders and stricter observance of the critical dates for the

application of the treatments. For the study of the 'masked' form of downy mildew on bunches of grapes described in *Agricultura, Madr.*, No. 101, 1940, a useful procedure consists in boiling the samples for investigation in a 5 per cent. potash solution and staining them in lactic blue, which throws the mycelium into sharp relief.

Andalusia was the only part of the country in which olives were attacked by *Gloeosporium olivarum* [*R.A.M.*, xxi, p. 243], but there the damage was considerable, especially in the late varieties, the development of the pathogen being favoured by the wet autumn and winter. Olive leaves from Lucena (Cordova) attacked by *Cycloconium oleaginum* [ibid., xx, p. 504] bore white lesions quite unlike those normally associated with this fungus, their presence being due, according to [L.] Petri, to the interposition of a stratum of air between the cuticle and the epidermis in the infected portions of the foliage. *Phoma fallens*, the agent of a so-called 'rain stain' of olive fruits in Saragossa, is suspected of causing a similar disorder of the same host in Cordova and Seville, but the absence of fructifications in the latter regions prevented the final determination of the pathogen. The lesions produced by *P. fallens* are much smaller than those due to *Macrophoma dalmatica* [ibid., xviii, p. 10], the common agent of 'rain stain', measuring barely 2 mm. in diameter as compared with 5 or 6 mm., and penetrating much less deeply into the fruit.

Weather conditions during the period under review were conducive to an intensive outbreak of chickpea [*Cicer arietinum*] blight (*Phyllosticta* [*Ascochyta*] *rabiei*) in the Andalusian provinces, where the crop in many cases was a total loss. In the province of Burgos, where vegetation was retarded by the cold, and spring sowing impeded by heavy rains, heavy losses were likewise observed.

Pear leaves from Aranjuez (Madrid) bore severe lesions characteristic of *Septoria piricola* [*Mycosphaerella sentina*: ibid., xix, pp. 134, 582], the pycnidia obtained from which, however, corresponded with those of *P. pirina* [*Phoma prunicola*: ibid., xvi, p. 106], reported as pathogenic to the same host in Italy but not hitherto observed on pears in Spain.

The abnormally heavy rainfall in 1941 favoured the luxuriant development of rye ergot (*Claviceps purpurea*), up to 12 sclerotia of which were counted in a single ear at Burgos. The disease, ordinarily confined to the humid regions of the north, spread to the central regions, including Madrid, where the damage, however, was negligible.

**Memoria de los trabajos realizados por la Estación de Fitopatología agricola de la Coruña. Anos 1939–40.** [Report of the work carried out by the Station of Agricultural Phytopathology of La Coruña in 1939–40.]—*Publ. Estac. Fitopat. agric. Coruña* 14, 35 pp., 1 map, 1941.

In the section of this report dealing with the work of the cryptogamic laboratory of the Corunna Station of Agricultural Phytopathology in 1939–40, J. R. Sardiña states that three walnut trees, two of 20 years old and the third younger, at Campolongo (Puentedeume), bore excrescences ranging from 2 cm. in diam. to 25 by 18 cm. scattered over all the branches. *Bacterium tumefaciens* being suspected as the causal organism, attempts were made to isolate it but without success.

J. R. Sardiña and P. Urquijo Landaluze give an account of a species of *Empusa* parasitic on the aphids *Aphis gossypii*, *A. laburni*, and *Capitophorus* (?) *whitei* on saltwort [*Salsola*], bean [*Phaseolus vulgaris*], and chilli plots at the Experiment Station. Its branched, claviform conidiophores, 96·9 to 110·5 by 8·5 to 11·1 $\mu$, bore subspherical primary conidia, with a truncate base and mucronate apex, 9·3 to 11·9 by 10·2 to 14·5 $\mu$, and hyaline spores, shaped like grape pips, 21 to 30 by 10 to 11·5 $\mu$. Affected aphids assume a chestnut to olive tinge. Inoculation experiments in the laboratory gave inconclusive results.

Soil acidity is believed by P. Urquijo Landaluze to be the primary cause of a rye disease involving such weakness of the ears that they slip from the sheath and bend over in the form of a crook; no grain is formed, with the result that the crop is a total

loss. The trouble occurs only over a limited area in the hilly district of Aranga, where the hydrogen-ion concentration of the soil is $P_H$ 5·4. All the affected plants revealed the presence of *Scolecotrichum graminis* (a new record for Galicia), which may have acted as a secondary cause of the disease. The correction of the acid condition of the soil by the application of lime at the rate of 100 kg. per 'ferrado' [12 sq. yds.] is recommended.

Good control of rye mildew (*Erysiphe graminis*), another new record for the province, was secured by dusting with sulphur, and spraying with a 1 per cent. suspension of sulphur in 3 per cent. soapy water or with 0·5 per cent. lime-sulphur.

'Blanching' of chilli, originally observed in Valencia [*R.A.M.*, xx, p. 225], was found to be also affecting the local crops, and investigations on the disease were pursued by J. R. Sardiña. Inoculation experiments with eight-months-old juice from infected plants were successful on chilli, two tobacco varieties (Cantabria and Tall Valencia), and *Nicotiana rustica* var. *erbasanta* to the extent of 50, 100, and 100 per cent., respectively, indicating that the virulence of the infective principle is maintained *in vitro* for the period named. The symptoms induced by the 'blanching' virus on tobacco closely resemble those of ordinary mosaic or tobacco virus 1, but it is considered probable that a virus complex is involved in the case of the chilli disease, since tobacco virus 1 does not induce the malformation of the fruits associated with blanching. Chilli plants inoculated with the juice of tobacco plants artificially infected by blanching developed no mottling but slight rugosity of the young leaves, thereby affording further proof of the complex nature of the virus.

Among the fungi isolated by J. R. Sardiña from a chestnut canker was an undetermined species of *Cytospora*, which may possibly prove to be the imperfect stage of *Endothia parasitica*. Inoculation experiments gave negative results.

Full particulars are given of a cultural and morphological study by P. Urquijo Landaluze on *Phytophthora cambivora*, the agent of ink disease of chestnut [see below, p. 434], 121 isolates of which were grown on various solid and liquid media; among the former, carrot slices and Leonian's malt extract agar afforded the most luxuriant development, while of the latter a synthetic medium containing 10 gm. asparagin was particularly favourable. A prominent feature of the cultures was the presence of 'reserve organs' of highly variable forms, ranging from rounded or spiniform hyphal enlargements to terminal extensions presenting divers irregularities, or assuming a uniformly spherical growth habit and simulating oospores, with an average diameter of 20 to 30 $\mu$. Further investigations are necessary to determine the exact nature of these organs, which may represent 'parthenogenetic oospores' to use Allain's term [ibid., xiii, p. 65] or chlamydospores. The results of isolation experiments on withered three- and seven-year-old chestnut trees confirmed the fact that the mycelium of *P. cambivora* penetrates the cambial zone of the stem in a tangential direction but does not enter the root until the onset of secondary decay by bacteria and saprophytes. Up to 100 per cent. of the isolation tests were successful, the incidence of positive results declining with the advancing age of the host; these observations are in sharp contrast to those of Petri in Italy and Milburn and Gravatt in the United States [ibid., xii, p. 337], who experienced great difficulty in the isolation of the pathogen from naturally diseased trees. Experiments are in progress on the control of the fungus by the application to the stem bases of copper oxychloride or copper carbonate.

Among other fungi new to Galicia, besides those already mentioned, were *Ophiobolus graminis* on wheat, *Macrosporium* [*Stemphylium*] *sarciniforme*, *Phoma destructiva*, and *Cladosporium fulvum* on tomato, *Cercospora beticola* and *Uromyces betae* on beet, *Oidiopsis taurica* on artichoke, and *Colletotrichum gloeosporioides* on orange.

SĂVULESCU (T.). **Rumania. Phytopathological events during the year 1941.**—*Int. Bull. Pl. Prot.*, xxxiii, 2, pp. 17M–19M; 3, 36M–39M, 1942.

In this report on plant diseases in Rumania in 1941 [cf. *R.A.M.*, xvii, p. 655] it is

stated that the diseases most frequently affecting sugar beet locally are *Cercospora beticola* [ibid., xxi, p. 114], mosaic, dry and heart rot [ibid., xxi, p. 266], and *Bacterium tumefaciens* [ibid., xx, p. 154]. On 3rd September, 1941, rust (*Uromyces betae*) [ibid., xx, pp. 292, 333] appeared for the first time at Cenad, Department of Timis Torontal, Banat, badly damaging the crops, especially those given chemical fertilizers. The most susceptible variety was Cesena C.

President Drouard pears growing near Bucarest were affected with bitter pit ('Stippenkrankheit'), first observed in Rumania in 1934, when it was found on apples.

Varieties of *Lupinus angustifolius* and *L. luteus* imported from Germany in 1937–8, have been attacked by wilt, only *Fusarium oxysporum* [ibid., xviii, pp. 116, 832; xx, p. 235] being isolated from infected material. Control is recommended by planting new crops on clean land and seed treatment with germisan, ceresan, or abavit.

Safflower crops near Bucarest were severely infected in July 1941 by *Puccinia carthami* [ibid., xix, p. 116], only the uredospore and teleutospore stages being found.

Up to 1934, the chief fungous disease of sunflowers in Rumania was *Puccinia helianthi* [ibid., xx, p. 596; xxi, p. 242], but in 1933 root and collar rot due to *Sclerotinia libertiana* [*S. sclerotiorum*: ibid., xvii, p. 128] caused serious infection in one locality, and later it appeared in others. During the summers of 1940 and 1941 sunflower heads were also attacked by a rot causing very severe damage, due to the same fungus. Atanasoff reported the disease on a number of important host plants in Bulgaria in 1934, sunflowers being one of the most severely attacked. In Rumania in 1933, the disease first developed on the main roots and collar of the sunflowers. In wet weather, the infected parts appeared as if scalded, and were covered with mycelium; in dry weather they had a dry and wilted aspect. Wherever the disease was present, the plants rotted, many being bent and broken. The losses amounted to 10 to 15 per cent. or more, particularly in wet, low-lying localities. In the autumn of 1940 the flowerhead rot was observed at Băneasa. The attack was very intense, and the affected inflorescences became useless. The principal effect was a softening of the flowerheads from the point of insertion to the edges. At this time the heads bore fruit, but where infection was present, the seeds remained small; most were shrivelled, and the kernels were brownish-yellow. The tissues also became soft at the base of the fruits in the infected part of the thalamus. Numerous sclerotia were found on attacked parts. In 1941, this flowerhead rot was present almost everywhere, in some localities, e.g., Northern Moldavia, causing 70 per cent. damage. Humidity appears to play an important part in the development of the disease. In laboratory tests, the optimum temperature for the development of the fungus varied between 17° and 20° C. In an experimental field in which three strains of sunflower were cultivated, one with black, one with spotted, and a third with white seed, the white-seeded strain was the most susceptible. Affected plants should be uprooted and burnt. Sunflowers should not be grown in low-lying, humid regions, and once an attack has occurred should not be grown in the same field for some years. Rotation and deep ploughing are also advised. Fertilizer applications appear to have no influence on the condition.

Leaves of *Caragana arborescens* showed spots due to *Septoria caraganae*, reported previously only in Germany.

**Fifteenth Annual Report of the Commonwealth Council for Scientific and Industrial Research for the year ended 30th June 1941.**—107 pp., 1941.

This report [cf. *R.A.M.*, xx, p. 339] contains, *inter alia*, the following items of interest. Detailed studies on a 9-acre wheat plot, where take-all (*Ophiobolus graminis*) [loc. cit.] again developed severely, though not in the same patches as in the previous year, showed that seedling blight was common. The condition also occurred in patches, and there was a correlation between the positions of the affected seedlings and the subsequent development of take-all at heading time. Root amputations showed that

during the exceptionally dry growing season of 1940 the plants depended chiefly on their seminal root systems for moisture throughout the growing period. This partly explains the unusually severe injury caused by early infection of the sub-crown internode or seminal roots with *O. graminis* in the same field. From the seedling stage to early maturity the dominant organism found in wheat roots in the same field was *O. graminis*, but later on species of *Fusarium*, *Helminthosporium*, and *Alternaria* were more common.

Highly significant differences were obtained between wheat crops in drums of soil inoculated the year before with *O. graminis* and crops in uninoculated control drums. The latter were badly affected, the former not at all. Apparently, the difference was associated with greater loss of soil nutrients to the heavy crops in the uninoculated drums during the previous year. This point is to be further investigated.

Apple internal cork [ibid., xx, p. 340] has now become uncommon in Tasmania. The effects of an application of borax at the rate of ½ to 1 lb. per tree were found to continue for at least five years.

Injection experiments to test all likely deficiencies failed to indicate any cause or cure of apple dimple [ibid., xvi, p. 471], and grafting experiments are now in progress.

Investigations on apple storage disorders have shown that the average size of the fruit per tree is related to the percentage disorder and chemical and physical properties of the fruit. The results form a basis for recommendations for the best average size for several varieties.

Six years' tests showed that delay in placing Cox's Orange Pippin apples in cool storage is uneconomic. With Jonathan, incidence of breakdown was greatest with immediate storage, of deep scald after one week's delay, and of Jonathan spot after two weeks' delay; on the whole, immediate storage was the most advantageous procedure [ibid., xxi, p. 374]. With Cleopatra apples storage may be delayed, provided shrivelling and yellowing are controlled.

To brown heart [ibid., xix, p. 545] Sturmer apples are very susceptible, while French Crab, Scarlet, Cleopatra, Tasman's Pride, Cox, and others are less so, and Jonathan, Granny Smith, Democrat, and Crofton resistant. Susceptibility varies from season to season with the same trees, and variation in degree of susceptibility has been observed in Sturmer grown in different soils. Susceptibility is more marked in light than in heavy crops, and increases with degree of maturity at picking. The longer the fruit is exposed to carbon dioxide during storage the lower the concentration must be to ensure freedom from brown heart. During 1937, the maximum safe concentration for Sturmer apples picked in May was about 3 per cent. for a storage period of eight weeks, and 10 per cent. for seven days, and these may be regarded as desirable storage limits for ships. Relatively early in the season, storage temperatures of 32° to 34° F. are more dangerous with a given concentration of carbon dioxide than temperatures of 38° to 40°. Later on, when susceptibility is greater because of delayed picking or cooling, higher temperatures become dangerous, and the highest (50° to 60°) seems to cause the most injury. Concentrations too low to produce brown heart may rapidly stimulate low temperature breakdown in susceptible varieties. Brown heart symptoms do not develop directly the fruit is injured. In fruit stored only two or three weeks, brown heart does not become apparent until about 48 hours after removal from storage.

In fruit storage studies, Jonathan apples kept in gas storage at 40° F. were still sound in January, though comparable fruit kept in air at 32° to 37° showed 10 per cent. wastage by July. 'Delicious' apples were more satisfactory at 32° than 34°, the higher temperature causing greater wastage from mould and breakdown. Gas storage at 32° greatly reduced mould wastage in this variety, but caused greater wastage from superficial scald. With the later pickings of Granny Smith apples, storage at 32° gave better control of mould and late scald than storage at 34°, but with the earlier pickings

there was more superficial scald at the lower temperature. At 40° Granny Smith apples kept much better in gas than in air storage.

A survey of the mould wastage in cold-stored apples from the 1940 crop in New South Wales showed that it was substantially higher in all varieties harvested at Batlow than in those from Orange. In all varieties in both areas it increased as the picking time was delayed. The most important agents of wastage were *Penicillium* sp. (probably *P. expansum*), *Gloeosporium* sp., and *Botrytis* sp. (probably *B. cinerea*).

In field and greenhouse tests, a potato condition known in New South Wales for some years as spindle tuber [ibid., xx, p. 340], and the effects of which on tuber shape resemble those of true spindle tuber, was not transmitted from affected to healthy plants, though true spindle tuber is readily transmissible.

Applications of fungicidal dusts to maize seed against *Diplodia zeae* had no adverse effect on germination or vigour of early growth except when inferior or diseased seed was used. The percentage of *Diplodia*-rotted ears in maize crops at Maffra and Lindenow varied with the moisture content of the soil during the growing period and the previous cropping of the land. There was considerably more ear rot on dry ridges and old maize land than in moister depressions or maize following pasture.

In plots of pine trees [*Pinus* spp.] to which superphosphate was applied at the rate of $1\frac{1}{2}$ cwt. or more per acre, with or without borax, the average diameter of the trunk at breast height increased by about 10 per cent., while in untreated plots or those treated with borax alone the figure was about 7·5 per cent. The phosphate-treated plots also showed a much higher percentage of recovery from needle fusion [ibid., xxi, p. 312], though in some the treatment had little or no effect, possibly owing to insufficient rainfall. Water-culture experiments demonstrated that boron is essential to the normal growth of *P. radiata* and *P. taeda* seedlings.

In experiments with soils of the prune orchards at McLaren Flat, near Adelaide, where a disease is present that resembles little leaf, pot tests were made with the object of diagnosing the cause of disease by growing annuals under different fertilizer treatments. Plants were then selected which exhibited well-marked symptoms when certain elements were withheld. This method gives more reliable information than chemical analysis of soils. It was demonstrated that the light soil at McLaren Flat lacks boron and manganese.

In wood preservation investigations both open-tank and pressure treatment of messmate (*Eucalyptus obliqua*) poles with coal tar creosote gave outstandingly good results, while superficial treatments, i.e., brushing with creosote over sapwood, charring, and the use of arsenic and arsenic and sodium fluoride collars were all unsatisfactory [ibid., xv, pp. 132, 332]. The best of the superficial treatments was oxyacetylene charring plus creosote spraying. After four to five years' exposure the only treatments of various pole species that failed were those with zinc chloride and arsenic and those with chemical bandages. The most toxic fraction of Australian vertical retort oils to three different wood-destroying fungi was that distilling at between 225° and 275° C.

The best control of mould wastage in stored grapes [cf. ibid., xix, p. 458; xx, p. 287] was given by placing a tablet containing 15 per cent. of sodium bisulphite and 4 per cent. of spermaceti with each bunch in the paper woodwool pack, or by treating the granulated packing cork with about 2·5 gm. iodine per lb. of cork. Both treatments almost doubled the period required for an appreciable development of mould at 32°. Treating the cork with the sodium salt of orthophenylphenol also delayed infection.

**Annual Report on the Department of Agriculture, Zanzibar Protectorate, 1941.**—4 pp., 1941.

In the section of this report [cf. *R.A.M.*, xx, p. 342] dealing with sudden death of cloves in Zanzibar it is stated that where regeneration can be undertaken before the

trees succumb, a sure and simple method is to plant seedlings midway between the old trees. A large block was so replanted early in 1937, and by 1940 all the older trees had died, and the seedlings were sufficiently tall and vigorous to allow the dead trees to be removed, leaving an excellent block of young cloves, which are now bearing. In another experiment begun in 1934, young cloves were planted between lines of still healthy trees, and the canopy of the latter was gradually reduced each year. Costing accounts show very little difference between the profit from this block and that from a control block, not interplanted and not lopped. Sudden death is widespread in the control block, but the experimental area now consists of a healthy block of young saplings, which, though temporarily rather etiolated, have been established at a very small cost.

Where clear felling has already been carried out, artificial shade has proved beneficial. The most successful plant so far found for this purpose is *Gliricidia maculata*; a large block of cloves under this shade suffered during the first years about only half the loss of comparable blocks without this shade. A new establishment trial started in 1941 includes the use of temporary shade by (1) *Gliricidia,* (2) bananas, (3) sugarcane, (4) cassava, and (5) *Gliricidia* and *Calopogonium.* The cloves were planted in April, 1942, when these crops had become established. The merit of *Calopogonium* is that it checks colonization by *Imperata* grass, a weed which interferes with the proper development of the lateral and fibrous roots of cloves.

Manurial tests failed to demonstrate any effect on cloves up to the age of six or seven years. Small trials are being made to ascertain the effect of time of planting on the incidence of sudden death.

**Annual Report of the Agricultural Experiment Station, Río Piedras, Puerto Rico, 1940–41.**—71 pp., 9 figs., 1941.

This report [cf. *R.A.M.*, xx, p. 563] contains, *inter alia,* the following items of phytopathological interest. L. A. Alvarez states that there are approximately 400,000 acres of coffee in Puerto Rico. The low average yield, amounting to only 200 lb. of dry beans per acre, is partly due to the presence of *Fusarium* root rot [ibid., xx, p. 564], which in some districts is the only limiting factor in production. Pathogenicity studies demonstrated that high temperature and humidity as well as high acidity of the soil favour infection. The virulence of the causal organism remained unaffected after it had been maintained in culture for 1½ years. Varietal tests in the laboratory demonstrated that the Columnaris variety in the seedling stage is as susceptible as the Puerto Rico variety.

Mosaic is a limiting factor in papaw production [ibid., xx, p. 565]. All attempts at transmission have so far failed, but inoculated and control plants, showing no symptoms while in the insectary, become infected when removed to the field and indicate that the disease may be carried by an insect vector.

A study by D. H. Cook and C. F. Asenjo of the papain and protein content of papaws affected with the virus disease complex showed that a diseased fruit yields only about one-tenth as much latex as a healthy one. The amount of active papain in the latex from diseased fruits is somewhat lower than in that of healthy ones (1,051 against 1,351 units as measured by the milk-clotting method per gm. of solids).

N. A. Schappelle states that in some seasons 30 to 40 per cent. of the pineapples grown in Puerto Rico are affected by gummosis [cause unspecified]. Such fruits cannot be exported, as they rot during transit.

A. Roque and J. Adsuar state that crosses and back-crosses have been made between varieties of sweet and pimento [? *Capsicum frutescens*] peppers resistant to mosaic [ibid., xix, p. 254; and above, p. 401] and commercial varieties. Improved types resistant to mosaic have been isolated from second-generation segregates. A variety recently introduced from Mexico has been found to be highly resistant and at the same time excellent for breeding purposes.

JENSEN (H. L.). **Bacterial treatment of non-leguminous seeds as an agricultural practice.**—*Aust. J. Sci.*, iv, 4, pp. 117–120, 1942.

This is a critical review of the recent literature on the bacterization, especially with *Azotobacter* spp., of non-leguminous seeds with a view to the establishment in the soil of a vigorous, free-living, nitrogen-fixing microflora. Of late years this problem, interest in which had largely declined owing to the many disappointments experienced, has been given renewed attention, particularly in the U.S.S.R., where it is considered to be of major agricultural importance both from the scientific and practical points of view [*R.A.M.*, xx, p. 534]. The conclusion reached by the writer is that the beneficial effects of bacterization have not been proved to result from nitrogen fixation by *Azotobacter* or the production of growth compounds by this or other micro-organisms: a more promising line of research would appear to be opened up by the utilization of specific bacterial antagonists for the protection of seedlings against certain plant pathogens susceptible to their destructive action.

MCINTIRE (F. C.), PETERSON (W. H.), & RIKER (A. J.). **A polysaccharide produced by the crown-gall organism.**—*J. biol. Chem.*, cxliii, 2, pp. 491–496, 1942.

In previous studies on the nutrition and carbon metabolism of *Phytomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xvii, p. 18; xxi, pp. 67, 130] a substantial amount of unidentified material was produced by the organism in a synthetic medium. Further investigations on the nature of this substance at the Wisconsin Agricultural Experiment Station have shown it to be a polysaccharide, a full account of which is given.

VOELCKER (O. J.), & WEST (J.). **Swollen shoot and die-back of Cacao.**—*Trop. Agriculture, Trin.*, xix, 5, p. 83, 1942.

The authors now consider that they were mistaken in their earlier view that cacao swollen shoot [*R.A.M.*, xx, p. 517] is only an incident in the general problem of cacao die-back. The results obtained by Posnette [ibid., xx, p. 452] clearly demonstrate that quite apart from the annual die-back caused by insect attack, drought, or faulty soil conditions, a new and highly destructive disease has become established in the Gold Coast.

Observations made during a visit to the Gold Coast in the middle of the rainy season in 1941 showed that the first symptom is the appearance of a distinctive yellowish or whitish chlorosis in the leaves, the veins remaining outlined in normal green but appearing to be thickened underneath. Completely healthy-looking leaves are never afterwards produced, though the degree of chlorosis varies considerably in later flushes. Progressive defoliation ensues, and as the rate of leaf production is reduced the foliage tends to appear as small tufts at the ends of bare, whip-like branches. At this stage the whole appearance of the tree is yellowish. The swollen shoots themselves are later symptoms. They result from an increase in the width of the woody tissues, and are larger in chupons than in branches. Diseased trees also produce characteristic small, round pods. Die-back follows the defoliation, and although chupons may be produced from the trunk, the tree almost invariably succumbs within twelve months. In any one farm individual trees are affected first. From these the disease spreads in expanding circles until the whole area has been destroyed. Spread appears to be unaffected by the age or condition of the trees, the presence of overhead shade, or the type of soil.

The probability is that swollen shoot originated in the Nankase-Akodum district at least as early as 1930. The principal area of infection already extends to nearly 250 square miles, and the continuous nature of the cacao belt provides ideal conditions for spread. Probably two-thirds of the cacao in the centre of this area has now succumbed to infection, and in some of the villages stacks of cacao trunks are being sold as firewood.

Numerous isolated outbreaks have occurred in healthy cacao bordering the main area of infection. At Tafo, for example, nearly 70 individual outbreaks have been found in the past two years. Fortunately, in any one individual outbreak, the rate of spread, though steady, is not rapid; spread to a depth of three or four trees all round is probably the maximum in a year. Thirteen isolated outbreaks have been found in other parts of the Gold Coast. The most distant are at Wiawso in the Western Province and at Peki in the Eastern Province, across the Volta river. Unconfirmed reports from Africans state that the disease has appeared in French Togoland. The primary object of the Department of Agriculture is to confine the disease within the limits of the main area of infection and eradicate the isolated outbreaks as they are found. Such measures are at present severely handicapped by incomplete information about the distribution of infection, the alternate hosts of the virus, and the insect vectors.

WANG (Y. C.). **Rust reactions of Chinese Wheat varieties and certain Canadian hybrid strains.**—*Canad. J. Res.*, Sect. C, xx, 2, pp. 108–115, 1942.

Heavy losses in yield of wheat which amounted in some years to only 20 or 30 per cent. of that expected, are stated to be caused in Honan, northern China, by the rusts *Puccinia graminis tritici* [*R.A.M.*, xiii, p. 566], *P. triticina*, and *P. glumarum*, the two last-named being the most harmful.

In greenhouse and field experiments, about 200 Chinese spring and winter wheats (mostly varieties of *Triticum vulgare*, *T. turgidum*, *T. durum*, or *T. compactum* were tested for their resistance to races 9, 15, 19, 21, 34, 38, 51, and 56 of *P. graminis* and races 1, 9, 58, and 76 of *P. triticina*, while 75 lines of Canadian wheat from a cross between Renown Selection (resistant to *P. graminis*) and Garnet (resistant to *P. triticina*) were used in greenhouse tests with races 6 and 13 of *P. glumarum*. None of the Chinese varieties was resistant to all races of *P. graminis*, although some were resistant to one or more races. Among varieties of the *T. vulgare* group, none was resistant to more than three races of *P. graminis*; in the *T. durum* group and among the unidentified winter wheats the proportion of varieties with some degree of resistance was greater than in the *vulgare* wheats. More resistance was displayed by Chinese wheats to *P. triticina*, several *T. vulgare* varieties showing resistance to all the four races tested. There was evidence of mature plant resistance in some of the varieties.

Of the 75 lines of Canadian wheat tested, 25 were used with both races of *P. glumarum*, and five found to be resistant to both races, one moderately so, and seven resistant to race 13 and moderately resistant to race 6; of the remaining 50 lines tested with race 6 only, 20 were immune or resistant. Since all these lines are resistant to *P. graminis* and most of them also to *P. triticina*, as it was found in a field test, they are considered to represent valuable breeding material.

STRAIB (W.). **Physiologische Untersuchungen über Puccinia glumarum.** [Physiological studies on *Puccinia glumarum*.]—*Zbl. Bakt.*, Abt. 2, cii, 7–9, pp. 154–188; 10–11, pp. 214–239, 8 figs., 2 graphs, 1940.

A fully tabulated discussion is given of the writer's further studies at the Gliesmarode (Brunswick) branch of the Biological Institute on physiologic specialization in the yellow rust of cereals (*Puccinia glumarum*) [*R.A.M.*, xix, p. 77], with special reference to the environmental factors controlling uredospore germination.

Differences between the various physiologic races in respect of the rates of germination and germ-tube growth, temperature relations, morphology, and longevity are best discernible on a solid medium, such as 2 per cent. water agar. The presence of water in a fluid state is a prerequisite condition for the germination of the uredospores, which proceeds somewhat more rapidly in subdued daylight than in absolute darkness, but only at temperatures above 15° C., below which point no difference in the growth rate was perceptible. Generally speaking 9° to 11° may be regarded as the

optimum germination temperature, though equally satisfactory results may be secured with fully viable uredospores at a range of 2° to 15° or even up to 22° in the case of individual races. The maximum germination temperature for most races fructifying between 15° and 17° is from 23° to 25°, or rarely up to 28°. Some races respond favourably to the incorporation with the medium of 0·005 M. of the primary phosphates of ammonium, potassium, and calcium, which in such cases raise the temperature maximum by 2° to 3°. Similar but less marked effects are induced by organic sources of nitrogen, e.g., peptone and asparagin, but no such influence was exerted by cane sugar as a carbon source. At temperatures below 12°, carbonic acid in concentrations of 3 and 6 per cent., especially the latter, retards and reduces germination and materially curtails the length of the germ-tube, whereas at 17° to 19° the velocity and extent of germination are increased by the same compound at 4·5 per cent., though the reduction in germ-tube development persists.

The optimum hydrogen-ion concentration of the medium for germination ranges from $P_H$ 5·5 to 6·5; at 4·5 germ-tube growth is substantially retarded but germinability is stimulated at 20°. In general, the minimum and maximum limits for uredospore germination in *P. glumarum* are $P_H$ 3·1 and 8·5, respectively.

Reference has been made by other workers, notably Sapin-Trouffy (*Botaniste*, v, pp. 59–244, 1896) and Ezekiel [*R.A.M.*, x, p. 712], to the formation of apical vesicles and secondary hyphae on the germ-tube of *P. glumarum*. In the author's experiments this phenomenon was chiefly promoted by the maintenance of fructification and germination temperatures of 20° to 25° and 12° to 15°, respectively, and by an acid reaction of the medium ($P_H$ 4·0), though it was also observed at temperatures just above freezing point. Different races vary in their propensity to the production of vesicles, which was mainly observed in race 23 from barley and race 7 from wheat. The secondary hyphae of the former proved to be much more resistant to extremes of temperature than the original germ-tubes, remaining viable for two months for instance, in a culture held just above freezing point.

Definite correlations exist between the germination rates and resistance to high temperatures of the individual races and their pathogenic properties, capacity to induce virulent infection on their hosts being associated with rapid germination and the ability to withstand heat. On an average the maximum temperature for the development of yellow rust infection lies 4° to 6° below that permitting uredospore germination. Absence of light does not preclude infection, which may take place in absolute darkness. Races of this type are ordinarily confined to regions in which high summer temperatures prevail, so that a selective action on physiologic specialization within *P. glumarum* may be attributed to climatic factors. Races of uniform virulence on a given host may be of different epidemiological importance on the grounds of their varying rates of uredospore germination and divergent reactions to high temperatures.

Bonne (C.). **Beitrag zur Flugbrandbekämpfung des Weizens. Untersuchungen zur Heisswasser-Kurzbeize.** [A contribution to the control of Wheat loose smut. Studies on the hot water short disinfection process.]—*Angew. Bot.*, xxiii, 5, pp. 304–341, 1 fig., 2 graphs, 1941.

In connexion with his experiments at the Strube-Schlanstedt seed selection establishment, Quedlinburg, Germany, on the control of loose smut of wheat (*Ustilago tritici*) by a short treatment with hot water, the writer has collected and summarized official reports on the economic importance of the disease in various parts of the world, from which the following inferences may be drawn. The disease is very prevalent in eastern Canada, where an incidence of 55 per cent. was recorded on wheat in 1934, but is steadily losing ground in the United States; substantial damage is caused by the smut almost every year in Uruguay and the Argentine [*R.A.M.*, xxi, p. 184], whereas in Chile it is practically unknown. In New Zealand loose smut infection of wheat and barley is regular but very slight, in New South Wales it was heavy on (?) wheat in 1933,

while elsewhere in Australia no significance attaches to the disease, the same being true of South Africa. Among European countries, France, Belgium, Rumania, and Hungary are widely affected, whereas in England, Denmark, Finland, and Italy the extent of infection is limited. As regards Germany, the writer in his travels throughout the country from 1935 to 1940 observed a rise in the incidence of loose smut both on wheat and barley, though the amount of infection on summer wheat never exceeded 10 per cent. According to statistics cited by Roemer [*et al.*: ibid., xviii, p. 195], *U. tritici* was responsible for 5·5, 5·0, and 3·6 per cent. of the total area rejected on account of disease in Germany in 1927, 1928, and 1938, respectively. Personal observations and experiments by the author demonstrated the importance of wind-borne infection in the dissemination of the disease, which is favoured by high temperatures and abundant atmospheric humidity, though the absence of these conditions, as for instance in 1935 and 1936, does not necessarily reduce the amount of loose smut to any appreciable extent. The necessity for the routine seed-grain disinfection of susceptible varieties is thus apparent.

The method of seed treatment finally adopted consists of two hours' continuous sprinkling with water treated to a temperature of 53° to 54° C. (8 l. per 100 kg.) in the Labor-Vorbereiter of the Miag-Braunschweig, a conditioning apparatus used in bakeries which has been described by Gehlé (*Z. ges. Mühlenw.*, 4, 1930). By this means the incidence of loose smut in Red Schlanstedt summer wheat was reduced from 63 per cent. to nil in 1934–5. Discussing the mechanism underlying this method of treatment, the author considers that the intramolecular respiration of the seed is stimulated by the presence of water, the rapidly increasing warmth, and the exclusion of oxygen, all of which factors simultaneously promote the advance of the loose smut mycelium to an appropriate stage for response to the destructive action of high temperatures. In one experiment seed treated at 53° C. for two hours in the absence of air yielded four infected ears per 20 sq. m., whereas that treated similarly but in the presence of air yielded 37 ears in the same area.

Blair (I. D.). **Studies on the growth in soil and the parasitic action of certain Rhizoctonia solani isolates from Wheat.**—*Canad. J. Res.*, Sect. C, xx, 3, pp. 174–185, 1 pl., 1 diag., 1942.

In this study of some growth characteristics of *Rhizoctonia* [*Corticium*] *solani* in soil, it was found, by the effective use of an adaptation of the Rossi and Cholodny glass slide technique, that the extent of growth of 11 isolates of this fungus, after both 6- and 12-day periods, was less in a vertical than in a radial direction. Some isolates grew significantly faster than others. When one fast and one slower-growing isolate were grown at soil depths of 2, 4, and 6 in., it appeared that in all the soil mixtures used both grew best at the 2 in. level, less so at 4 in., and least of all at 6 in. It would seem that a low moisture content and good aeration prevailing at the upper soil stratum favour the growth of the fungus.

The results of pathogenicity experiments with ten isolates of the fungus on wheat showed a higher disease rating for all isolates in the unsterilized than in the steam-sterilized soil, and in the soil with a proportion of inoculum to soil of one to six than of one to three. The addition of 1 per cent. grass or straw meal to the unsterilized series reduced the amount of infection. There were two quite distinct types of symptoms: one, produced by two slow-growing isolates of English origin, was a form of root injury ranging in severity from a slight root tip necrosis to an extremely severe form resulting in almost complete destruction of the entire primary and secondary roots; and the other, produced by faster-growing isolates from Canadian sources, was characterized by brown lesions girdling the coleoptile above the kernel without any adverse effects upon the plant growth. It is thought that the English isolates may belong to a different species of *Corticium* altogether, but pending the discovery of their sporiferous stage, it is proposed to regard them as a variety of *C. solani*.

Carter (W.). **Peregrinus maidis (Aslim.) and the transmission of Corn mosaic. I. Incubation period and longevity of the virus in the insect.**—*Ann. ent. Soc. Amer.*, xxxiv, pp. 551–556, 1941.

A tabulated account is given of the writer's studies on *Peregrinus maidis* in relation to the transmission of maize mosaic [*R.A.M.*, xi, p. 591; xix, p. 556] at the Pineapple Experiment Station, Honolulu, Hawaii, the results of which showed that the normal incubation period of the virus in the leafhopper ranges from 11 to 29 days, the occasional occurrence of a phenomenally brief period in insects of related colonies being attributed to the influence of genetic factors. The virus persists in the leafhopper, and in the majority of cases is transmitted uninterruptedly to a series of plants when two-day feeding periods are allowed, but there were a few cases of breaks in the succession of positive transmittals, apart from those incidental to the death of the insect. Some of the leafhoppers lived for six days or more after the last positive transmission, with which the available virus supply was evidently exhausted. The latent period of development of mosaic in the maize plant was found to range from four days on young, vigorously growing plants, to 20 or over in those making slower progress.

Marchionatto (J. B.). **El 'verdin' del Maíz.** [The 'mildew' of maize.]—*Rev. Fac. Agron. B. Aires*, ix, 3, pp. 159–169, 2 col. pl., 4 figs., 1942. [English and Portuguese summaries.]

On various occasions since 1928 samples of maize infected by 'mildew' have been referred to the Argentine Ministry of Agriculture as the causes of poisoning in pigs and horses, and in 1940 a study was conducted on the etiology of the disease. Infected seeds are characterized by a greenish coloration of the scutellar region, which looks blue when viewed through the pericarp and has given rise to the common name of 'blue eye' in the United States [*R.A.M.*, xvii, p. 519]. The pericarp, intact at first, finally contracts and ruptures longitudinally, liberating a greenish powder consisting of the spores of the mould. Infection progresses from the enveloped cotyledon to the gemmule and radicle, and subsequently involves the entire embryo and the tissues underlying the endosperm, which ultimately become disorganized and emit an odour suggestive of alcohol. The cells of the embryonic tissues were found to be traversed in all directions by a very slender ($2{\cdot}5\,\mu$) hyaline mycelium, the fructifications produced by which were those of a typical *Penicillium*.

Of the four isolations of *Penicillium* and one of *Aspergillus* obtained from 117 mildewed maize samples, only two of the former reproduced the typical symptoms of the disease in inoculation experiments carried out along the same lines as Koehler's [loc. cit.]. Within the temperature range used for the tests (17° to 25° C.), moisture was the controlling factor in the development of mildew, the incidence of which extended from 42 to 68 per cent. at a relative humidity of 98 per cent. and fell to nil at 60 per cent.

The two pathogenic isolates, the cultural characteristics of which are described, were identified by C. Thom as strains of *P. viridicatum* [ibid., xiv, p. 237; xviii, p. 173].

Good results were obtained in laboratory experiments by dusting the infected seed-grain with Naaki (commercial crystalline silicon anhydride) at a concentration of 3 to 4 per cent. by weight. This substance absorbs moisture transpired by the stored grain and thus prevents the humidity which favours moulding.

Gonçalves (C. R.). **Observações sobre Pseudococcus comstocki Kuw., 1902, atacando Citrus na Baixada Fluminense.** [Observations on *Pseudococcus comstocki* (Kuw., 1902) attacking Citrus in Baixada Fluminense.]—*Rodriguésia*, iv, 13, pp. 179–198, 39 figs., 1940. [English summary.]

In Baixada Fluminense (States of Rio and Distrito Federal, Brazil), the roots of orange and grapefruit trees are extensively colonized by the mealy bug *Pseudococcus*

*comstocki*, over which a crust, up to 40 cm. in depth, is formed by a fungus identified by J. Rick as *Boletus tropicus*. The chestnut-coloured sporophores of the latter, 10 to 15 cm. in height and 5 to 25 cm. in diameter, appear on the surface of the ground immediately above the infested roots, to which the mealy bug is conveyed by the fire ant, *Solenopsis saevissima* var. *moelleri* Forel. On the foliage and branches of the trees *P. comstocki* also forms abundant colonies, again with the assistance of the ant and under the protection of a layer of sooty mould (*Capnodium*) or 'felt' (*Septobasidium pseudopedicellatum*) [*R.A.M.*, xx, p. 13]. The depredations of the mealy bug are most severe during the dry period from May to December. Measures for the direct control of subterranean infestation and for preventing the development of the insect, above and under ground, are described.

MILANEZ (F. R.). **Observaçoes sobre uma estranha doença das Laranjeiras.** [Observations on a strange disease of Oranges.]—*Rodriguésia*, iv. 13, pp. 199–263, 18 pl., 7 figs., 1940.

A full description is given of the writer's cytological examination of the Rangpur lime (*Citrus aurantifolia*) roots on which were grafted the orange trees suffering from the mealy bug (*Pseudococcus comstocki*) infestation [see preceding abstract]. The great majority of the roots were occupied by an endophyte [cf. *R.A.M.*, xv, p. 365] to which their actual death is attributed, the *Boletus tropicus*-mealy bug complex merely serving to weaken the tissues and facilitate the attack of the parasite. This is believed to be the first record of citrus mycorrhiza in South America. Attention is drawn in both these papers to certain analogies between the disease under observation and the vine and coffee maladies associated with *Bornetina corium* and *Polyporus coffeae*, respectively [ibid., xxi, p. 287].

SINGH (L.), SINGH (B.), & KHAN (A. A.). **Citrus manuring. I. Fertilizer experiment with sweet Orange (Malta) growing on rough Lemon.**—*Indian J. agric. Sci.*, xi, 5, pp. 778–793, 1942.

In manurial experiments conducted from 1933 to 1938 at Lyallpur, India, it was observed that the lack of organic matter in the soil caused mottle leaf [*R.A.M.*, xix, p. 641] in Malta oranges (*Citrus sinensis*) growing on a seedling rough lemon (*C. limonia*) rootstock, both in the plots fertilized with varying amounts of ammonium sulphate and in the untreated control.

FENTON (F. A.) & CHESTER (K. S.). **Protecting Cotton from insects and plant diseases.**—*Circ. Okla. agric. Exp. Sta.* 96, 32 pp., 12 figs., 1 map, 1942.

Directions are given in popular terms for the control under Oklahoma conditions of cotton root rot (*Phymatotrichum omnivorum*) by crop rotation; of wilt (*Fusarium vasinfectum*) by the cultivation of such resistant varieties as Stoneville 2-B and Roldo Rowden and the use of a potash-containing fertilizer; and of bacterial blight (*Phytomonas* [*Xanthomonas*] *malvacearum*), the most prevalent disease in the State, by seed treatment with new improved ceresan or 2 per cent. ceresan (1½ and 3 oz. per bush., respectively, at a cost of 4 to 6 cents per bush.), or delinting with sulphuric acid (½ gal. per bush.) [*R.A.M.*, xxi, p. 252], combined with crop rotation. Seed treatment is also recommended for the control of boll rots [including *Glomerella gossypii*, *Gibberella fujikuroi* and *Corticium solani*: ibid., xxi, p. 196].

**Progress Reports from Experiment Stations, season 1940–41.**—216 pp., 9 graphs, London, Empire Cotton Growing Corporation, 1942.

These reports [cf. *R.A.M.*, xx, p. 402] contain, *inter alia*, the following items of interest. At Barberton, South Africa, the cotton was severely affected by premature leaf fall associated with *Alternaria* sp. [ibid., xix, p. 532]. The disease is confined to red loam soil at the Station, and all attempts to correlate its incidence with climatic

conditions and manurial treatments have so far failed, though fertilizer applications which have induced visibly better growth have retarded the onset of the condition. All varieties are affected, but the later-fruiting types hold out longer.

The progress report on plant pathological work at Barberton by G. M. Wickens (pp. 43–64) relates to the previous season (1939–40) and gives the results obtained in a further and more detailed and extensive survey of internal boll disease [*Nematospora gossypii* and *N. coryli*] and external or bacterial boll diseases [*Xanthomonas malvacearum* and organisms Y and G] in relation to insect vector activities and climatic conditions [loc. cit.]. The survey method proved valuable in defining the boll disease problems that would best repay intensive study, and in indicating those factors that exercise a strong controlling influence on the incidence of these diseases. The results obtained showed that the incidence of internal boll disease was slight, but that it increased progressively with lateness of boll formation, though it was less than was expected in the bolls formed last of all. The loss caused by the disease was considerably less than that caused by direct injury due to bug attack. As between different varieties of cotton the ratio of percentage loss of crop caused by bug feeding injury alone to percentage loss due to internal boll disease, with or without accompanying direct injury, did not vary appreciably. It therefore appears to be reasonable, in comparing varieties in their reaction to stainer populations, to take the figure for percentage loss of crop caused by direct injury and internal boll disease, together, as a comparative index of the incidence of either of the components, as well as an estimate of the absolute incidence of both together. The evidence also indicated that differences between strains and varieties in incidence of direct bug feeding injury and internal boll disease appear to be in conformity with the hypothesis that incidence is largely controlled by the measure of escape of the developing bolls from bug feeding; the earlier the fruiting habit of the plant, the greater is this measure of escape.

Data were obtained on the incidence of bacterial boll rots of two types, in which access to the lint was gained by (*a*) bacterial penetration through the boll wall, nearly always at the extreme base of the boll, and (*b*) through a channel at the tip of the boll which resulted from incomplete union of the carpels, the latter type being relatively very uncommon. It was apparent that the earliest bolls had suffered most; not only was the proportion of affected bolls higher in the earlier than in the later-formed groups, but also the extent of damage in affected locks was greater. As a result the crop on the late-fruiting plants heavily infested experimentally with bollworms [?*Heliothis armigera*] suffered less than that on the non-infested earlier plants, the figures for percentage of locks attacked and estimated loss of crop being respectively, 12·3 and 8·6 per cent. for the heavily infested plants, and 21·8 and 13·1 per cent. for the non-infested controls. Rainfall and humidity during the period of rapid boll growth are probably important factors, since except for the very late settings, the incidence of bacterial boll disease was positively correlated with rainfall during the formative periods of the bolls.

The incidence of external boll disease in the strains and varieties 9363, H. 19, B.P. 50/3, 0268, 6250, 5143, and 929 was determined in 24 plants of each variety. Indications were noted of some resistance in 6250, H.19, and B.P. 50/3.

In the more uncommon type *b* of external boll disease mentioned above, the incompletely joined carpels appeared to occur only in bolls that passed their early stages of development during exceptionally heavy rainfall. Some strains seem more apt to develop such malformations than others. In type *a* the fact that infection occurred nearly always at the extreme base of the boll, though occasionally elsewhere, may possibly be due to a particular susceptibility to infection of certain tissues in this region, or to the fact that at flower drop and for a day or two afterwards the calyx forms a cup round the base of the very young boll, in which drops of water, perhaps carrying bacteria, would easily lodge.

In early planted crops of normal growth in two seasons damage from type *a* disease

was greatest in the early formed bolls, which were subject during the early part of their development to heavier rainfall than those formed later. There is, however, some indication that crops weakened by drought may be badly affected by external boll disease. Such plants have thin boll walls, and there is reason to believe that thickness of boll wall may be an important factor governing extent of loss from this disease.

That data obtained from analytical survey methods of the kind reported in this paper may be adequately interpreted, studies should be instituted along the following lines, viz., (*a*) the feeding habits of stainers and pentatomids of all instars, particularly their choice of food when flowers and bolls of all ages are freely available, (*b*) the reaction of bolls of all ages to bug feeding, (*c*) the reaction of bolls of all ages to infection by internal boll disease, and (*d*) the efficiency of all instars of stainers and pentatomids as vectors of internal boll disease. Satisfactory methods for (*a*) and (*b*) already exist and have been used by Rainey and Pearson. With regard to (*c*) the author has found the following technique to be both simple and effective. 'Sterile' stainers reared in cages on dry cotton seed from sterile bolls and water made available on a continuously moist cotton wick were converted into vectors of internal boll disease by replacing for a few days the wick by another moistened with a heavy aqueous suspension of spores of *N. gossypii* obtained from young artificial cultures on potato dextrose agar. Stainers so treated, and then at once caged singly on sterile bolls two or three weeks old for a few days, regularly produced infection, which was confirmed by microscopic examination of every affected lock.

In February, 1940, an outbreak of cotton wilt occurred in one field at Barberton, and a fungus corresponding generally with *Verticillium dahliae* was isolated from diseased material. Infection was characterized by extensive vascular browning readily apparent on removal of leaves, conspicuous mottling of leaf laminae markedly different from that of normal leaf senescence, premature leaf fall, and dwarfed growth of green younger leaves.

At Bremersdorp, Swaziland, most of the loss of crop was due to bacterial boll rot in the early bolls, while *Alternaria* was prevalent early, especially on granite soil.

In Southern Rhodesia, probably owing to the short rainy season, there was little angular leaf spot [*X. malvacearum*] and no sign of blackarm.

In the Gezira (Anglo-Egyptian Sudan) selection work for leaf curl resistance was continued. Of 2115 selected M.S.D.S. (Massey's Selected Domains Sakel) plants (87/39, 123/39, 133/39, 142/39, and N.T. 97/40), 99 became affected, and of 2,305 controls 220 showed the disease. The general mean number of infected plants per line was 1·43 for the selections and 3·19 for the controls.

At Shambat Sub-Station, the propagation in bulk of the first trial lots of blackarm-resistant Sakel cotton has permitted the work of the Station to be extended. This bulked fifth back-cross material was of typical N.T. 2 appearance, and preliminary small-scale spinning tests gave satisfactory results. This material is to be followed by seventh back-cross strains of N.T. 2 and X. 1730 type homozygous for resistance, seed for the propagation of which has been secured. As a precautionary measure, crossing has been continued to the ninth back-cross. A new blackarm resistance factor, $B_3$, has been isolated from *Gossypium punctatum*, and is being transferred to both Sakel and American cottons. Experimental evidence demonstrated that a strain of cotton resistant to leaf curl in one area is not necessarily resistant in another.

To prevent deterioration due to seed admixture and outcrossing in blackarm-resistant Sakels, the *arboreum* gene for red flowers and foliage has been incorporated in resistant strains now ready for bulk propagation.

Momtaza bamia (*Hibiscus esculentus*), a selection moderately resistant to leaf curl and Egyptian bollworm, has been propagated in bulk, and is rapidly replacing the local crop.

In district variety trials in Uganda the mean blackarm lesions per plant shown by

a local variety, B.P. 52, B. 181, and X. 3, were 2·58, 2·33, 0·5, and 1·85, respectively, B. 181 being significantly better than the other varieties at all centres. At Kawanda, following severe hail storms, blackarm was more prevalent than usual. The sporadic appearance of *Verticillium* wilt [*V.* ? *dahliae*: ibid., xix, pp. 342, 646] made it very difficult to estimate varietal differences in susceptibility. A new technique to ensure even infection by wilt was devised. Seed was germinated, and the seedling uprooted before any root hairs had developed and dipped in a liquid culture of the fungus. The plants were then placed in banana fibre pots, and when they had become established, the bottom of each pot was removed, and the whole planted out in the field. Among varieties to which this treatment was applied, the U.S.A. strain Delfos 4 was outstanding for resistance, while B.P. 50 was again very susceptible.

Di Fonzo (M.). **Las enfermedades del Algodonero en la República Argentina.** [Cotton diseases in the Argentine Republic.]—*Bol. Junta nac. Algodón, B. Aires*, 80, pp. 951–978, 27 figs. (23 col.), 1 diag., 1941.

This useful survey of the symptomatology, etiology, mode of propagation, economic importance, and relationship to environmental factors and control of cotton diseases in the Argentine includes observations on angular leaf spot (*Phytomonas malvaceara*) [*Xanthomonas malvacearum*], anthracnose [*Glomerella gossypii*], sore shin (*Corticium vagum* or *Rhizoctonia solani*) [*C. solani*], wilt (*Fusarium vasinfectum*), boll rots associated with various organisms, e.g., *Monilia sitophila*, *Rhizopus nigricans*, *Cephalothecium* [*Trichothecium*] *roseum*, and *Aspergillus niger*, rust [*Cerotelium desmium*], crown gall (*Bacterium tumefaciens*), sooty mould (*Capnodium* sp.), yellow mosaic, and ring spot. A separate section is devoted to the question of seed treatments.

Langford (G. S.), Vincent (R. H.), & Cory (E. N.). **The adult Japanese Beetle as host and disseminator of type A milky disease.**—*J. econ. Ent.*, xxxv, 2, pp. 165–169, 1942.

Laboratory studies at the University of Maryland and field observations in various parts of the State have shown the Japanese beetle [*Popillia japonica* Newn.] to be (1) a host of the milky disease (type A) [*Bacillus popilliae*: *R.A.M.*, xxi, p. 78], (2) a factor in the spread of the causal organism, and (3) a possible medium for the propagation of spores for use in the artificial dissemination of infection. Evidence of (1) was afforded by the presence of the disease in an adult reared from a larva developing in infested soil and in adults reared from inoculated larvae or inoculated with spores of the bacillus; of (2) by the discovery of milky disease in adults collected in the field and the development of infection among larvae held in soil mixed with spores from diseased adults; and of (3) by the ready development of infection in inoculated adults.

Davis (B. L.), Smith (Ruth T.), & Smith (C. E.). **An epidemic of coccidioidal infection (coccidioidomycosis).**—*J. Amer. med. Ass.*, cxviii, 14, pp. 1182–1186, 1942.

In May, 1940, seven out of 14 university students and faculty members contracted infection by *Coccidioides immitis* on a field trip to a region contiguous to the San Joaquin Valley, California. All the invalids and two of the others, who had apparently been immunized by previous infection, were subjected to a heavy exposure of dust from the soil, from which the fungus was recovered. Moderately severe symptoms, of three to six weeks' duration, accompanied the infections in six out of the seven cases, but none of the patients developed coccidioidal granuloma.

Elles (Norma B.). **Rhinosporidium seeberi infection in the eye.**—*Arch. Ophthal., N.Y.*, N.S., xxv, 6, pp. 969–991, 1 col. pl., 5 figs., 1941.

In connexion with a case of ocular rhinosporidiosis, *Rhinosporidium seeberi*, in a 14-year-old boy in Texas, the third recorded in the United States [cf. *R.A.M.*, xix, p. 218], the writer critically discusses the causal organism in its taxonomic, morphological, historical, histopathological, etiological, clinical, and therapeutic aspects, gives

particulars of its occurrence in animals, cultural and experimental work, and geographical distribution, and fully reviews the relevant literature.

Pratt (H. N.) & Roorbach (Carolyn L.). **Species specificity of Alternaria in asthma and hay fever.**—*J. Allergy*, xii, 5, pp. 431–437, 4 diags., 1941.

At the Children's Hospital, Boston, 28 patients were tested by the intracutaneous method with four species of *Alternaria* from (1) carnation blight, (2) dying geraniums, (3) decaying squash (all from the Massachusetts Agricultural Experiment Station), and (4) air of the city. All the children except one reacted to all four *A.* spp. but usually failed to respond to other fungal genera; the 28th patient remained insensitive to one species throughout the tests. Of 13 adults subjected to similar tests at the Massachusetts General Hospital with *A. circinans* [*A. oleracea*], *A. solani*, *A. geophila*, *A. radicina*, *A. mali*, and *A. iridis*, seven reacted strongly to all six species, three to five, one to three, and two to two. These results indicate that species of *Alternaria* of divergent biological origin and varying morphological characters contain a common atopic excitant, but *in vivo* and *in vitro* experiments afforded only partial confirmation of this hypothesis. The fact that a species from the air and that isolated from squash, both heavy spore-producers, neutralized the reagins to all the others tested suggests that the conidia are the principal part of the mould concerned in the etiology of respiratory allergy.

Pratt (H. N.), Colmes (A.), Fromer (J.), Greene (J. E.), Chafee (F. H.), & Clapp (W. B.). **Pollen and mold survey of southeastern New England—1940.**—*New Engl. J. Med.*, ccxv, 14, pp. 533–538, 7 graphs, 1941.

Unlike the plant pollens concerned in the production of respiratory allergy in south-eastern New England, *Alternaria* [see preceding abstract] can be cultured from the air of Boston throughout the year, though the heaviest contamination coincides with the warm weather period, commencing in July and culminating in late September.

Dillman (A. C.) & Stoa (T. E.). **Flax seed production in the north central States.**—*Fmrs' Bull. U.S. Dep. Agric.* 1747, 19 pp., 9 figs., 1 graph, 1 map, 1942.

The following notes on flax diseases in the north-central States of North and South Dakota, Minnesota, and Montana are contained in this bulletin, which supersedes No. 1328 in the same series (1935). Control of wilt [*Fusarium lini*] by the cultivation of such resistant varieties as Bison, Buda, Linota, and Redwing is now generally practised, and one of the aims of breeders should be the combination of resistance to wilt with a similar reaction in respect of rust [*Melampsora lini*], from which most strains of Argentine, a few of Indian, Newland, Ottawa 770 B, Cirrus, and a group of hybrids are immune. Argentine varieties appear to be particularly susceptible to 'pasmo' [*Sphaerella linorum*: *R.A.M.*, xxi, p. 246], the introduction of which into new territory by way of the seed should be avoided as far as possible.

Ferguson (W.). **Sleepiness in Carnations.**—*Sci. Agric.*, xxii, 8, pp. 509–518, 4 figs., 1942.

Investigations conducted in Ontario, Canada, indicated that sleepiness of cut carnations, a disorder characterized by partial to complete closing of the flower from which there is no recovery, is probably not due to faulty cultivation, but rather caused by some factor during transportation. It was observed that carnations stored in the presence of ripe apples become sleepy, and it was tentatively suggested that this is caused by ethylene given off by the fruit. In tests with pintsch gas (containing ethylene), which is used in the lighting and cooking fixtures of trains, exposure to a concentration of 100 p.p.m. (equivalent to 16 p.p.m. of ethylene) for 24 hours caused sleepiness in all but one carnation after two days, and to one of 250 p.p.m. (equivalent to 40 p.p.m.) for 10 hours made 8 out of 12 carnations sleepy after 6 days. Both con-

centrations were within the figures obtained for analyses of gas samples from express trains. It is suggested that sleepiness might be prevented by using air-tight, ventilated containers for package. Another line of control was indicated by the fact that no sleepiness developed when carnations were exposed to pintsch gas at a temperature of 43° to 45° F. It is thought possible that there is a critical temperature below which the gas is not harmful to carnations.

Dodge (C. W.). **Helminthosporium spot of Citronella and Lemon Grass in Guatemala.**—*Ann. Mo. bot. Gdn*, xxix, 2, pp. 137–140, 1 pl., 1942.

*Helminthosporium cymbopogi* Dodge n. sp. is the name applied to the causal organism of a foliar spot of citronella (*Cymbopogon nardus* subsp. *genuinus*) and lemon grass (*C. citratus*) on a large plantation on the coastal plain below Escuintla, Guatemala. The spotting begins with the formation between the veins of small, yellowish areas, which elongate into elliptical or nearly linear, necrotic, red-bordered lesions similar to those of *H. sacchari* [cf. *R.A.M.*, xx, p. 229] on sugar-cane; the central portion soon turns brown and shrivels but does not drop out. With an increase in the number of spots wilting of the distal part of the leaf ensues, followed by death.

The conidiophores of the fungus, which was easily isolated on Thaxter's potato glucose agar and developed equally well on Sabouraud's glucose agar, are stiff, erect, of a smoky to dark brown colour, simple, and bear singly or in small groups, terminally and laterally (apically only on the host) tri- to quinqueseptate, asymmetrical conidia, measuring 24 to 35 by 8 to 15·5 (average 29·5 by 12·4) $\mu$ from *C. nardus* and 19·5 to 28·6 by 7 to 15 (25·8 by 10) $\mu$ from *C. citratus*, these dimensions being somewhat smaller than those of the spores on the host (46 to 54 by 18 to 24 (49 by 20) $\mu$). In the original cultures on potato glucose agar, the large subterminal cell of the conidium often proliferated laterally, producing an organ suggestive of the staurospore of *Triposporium*, but this type of growth did not occur in subcultures. Spore germination is effected by means of a tube from the basal cell which either penetrates between the epidermal cells and then enters them or produces a dichotomously branched mycelium.

Preliminary experiments indicate that the leaf spot may be combated by spraying with Bordeaux mixture or lime-sulphur, but a more promising approach to the problem of control, in view of the prohibitive cost of fungicidal treatments, lies in the selection of resistant clones, and measures in this direction are already in progress.

Wilkinson (E. H.). **Dieback and canker of Apple branches caused by a Gloeosporium sp.**—*Gdnrs' Chron.*, Ser. 3, cxi, 2896, p. 269, 2 figs., 1942.

In 1941 and 1942 Cox's Orange Pippin and Laxton's Superb apple trees at Bidford-on-Avon, Worcestershire, were attacked by severe die-back and canker. Infection had taken place through summer pruning cuts in 1941. The trees had been planted in 1935 on land previously heavily manured for vegetable cultivation. In 1940, the trees were summer-pruned, and slight die-back occurred; the operation was repeated in 1941, and a very high proportion of the cuts became infected. All trees allowed to go to grass and not summer-pruned remained unaffected. Infected material showed the presence of a *Gloeosporium*, possibly *G. fructigenum* [*Glomerella cingulata*]. Inoculations of three- to five-year-old twigs of Cox's Orange Pippin gave typical symptoms, the fungus being re-isolated from the cankers. The disease is occasioned by summer pruning and injudicious manurial treatment, the former being the more important factor. Affected branches should be removed and burnt and winter substituted for summer pruning. Apples left on the trees or lying on the ground should also be removed and burnt.

Wormald (H.). **A stalk-end rot of Apples.**—*Gdnrs' Chron.*, Ser. 3, cxi, 2891, p. 220, 1942.

In August, 1941, the author received two apples grown in a Surrey garden and

affected with a stalk-end rot, one of which showed the presence of *Botrytis cinerea* [*R.A.M.*, xx, p. 169] while the other bore the pycnidia of a species of *Phoma*, with cylindrical spores, rounded at the ends, measuring about 7 by 3 $\mu$, extruded in yellowish-brown globules. A further lot of apples from the same garden also showed the presence of the same fungi, and in addition another species of *Phoma* which later produced white, curled tendrils of small spores. The two species of *Phoma* have not yet been identified. When grown in pure culture and inoculated into mature apples taken from storage they readily caused infection.

Hopperstead (S. L.) & Kadow (K. J.). **How to reduce spray injury losses on the Peninsula.**—*Trans. Peninsula hort. Soc.*, xxxi, 4, pp. 39–40, 1942.

Spraying tests conducted during the past four seasons in Delaware [apple] orchards demonstrated that much of the fruit russet that developed was due to the use of liquid lime-sulphur in combination with lead arsenate during the calyx and first cover periods. Copper materials applied before the pubescence was off the young fruits also caused much russet. Russet and leaf injury were produced by the use of insoluble coppers without lime or with fixed nicotine materials; with fixed nicotines the injury was greater. When the insoluble coppers were used with lime, they were as safe as Bordeaux mixture (1–3–100). Bordeaux mixture (3–5–100) badly damaged fruit varieties susceptible to injury by copper. The insoluble coppers were inadequate to control arsenical injury, reduced codling moth [*Carpocapsa pomonella*] control, and failed to give satisfactory control of bitter rot [*Glomerella cingulata*].

The evidence obtained indicated that liquid lime-sulphur should not be used after the bloom period and should never be combined with lead arsenate. Milder sulphurs, such as the paste sulphurs, are recommended, and if applied thoroughly and promptly give perfect control of scab [*Venturia inaequalis*]. Copper sprays should not be applied to young apples before the pubescence has gone, as any injury to it will appear as russet later. As a rule, copper materials are safe in the third cover spray. For the best control of arsenical injury during summer and for the control of the usual summer diseases, Bordeaux mixture 1–3–100 in every spray, or 2–4–100 in alternate sprays, is the most effective material. When bitter rot presents a problem, it may be necessary to use Bordeaux mixture at a concentration of 4–4–100, the concentration required depending on the susceptibility of the variety to the disease, the severity of infection, and the tolerance of the variety to copper.

The best and safest schedule appears to be: sulphur paste during the scab season whenever possible, or liquid lime-sulphur in the pre-bloom sprays and sulphur pastes during the rest of the scab schedule. From the third cover spray onwards, Bordeaux mixture (1–3–100) should be included in every spray, or 2–4–100 in every alternate spray, as necessary. Individual instances may arise when the 1–3–100 concentration may be applied in alternate sprays only. If bitter rot is a problem, the concentration of the Bordeaux mixture must be increased.

Wilson (E. E.). **Experiments with arsenite sprays to eradicate Sclerotinia laxa in stone-fruit trees as a means of controlling the brown rot disease in blossoms.**—*J. agric. Res.*, lxiv, 10, pp. 561–594, 2 figs., 4 graphs, 1942.

Calcium, zinc, and sodium arsenite sprays were tested in about 161 trials from 1938 to 1940 for the control of *Sclerotinia laxa*, the fungus almost exclusively responsible for serious blossom blight (brown-rot disease) [*R.A.M.*, xxi, p. 27] in apricots, almonds, plums, and prunes in California. The conidia borne on the sporodochia of the fungus are stated to be the primary inoculum for blossom infection in the spring, since no apothecial stage of the fungus has been found in the State. The sprays were applied at the period of maximum sporodochial development, which, though varying somewhat from year to year and from district to district, extended from early January

to late February. The best control was obtained with calcium arsenite, which at the rate of 4 lb. per 100 gals. water reduced sporodochial development by 98 to 99 per cent., while rates of 3 and 2 lb. per 100 gals. were somewhat less efficient, and even at 1 lb. per 100 gals. eradicatory effects were noticeable though not always consistent. The higher concentrations proved, however, too injurious, particularly to almonds, and the safest concentration for all fruits is considered to be 2 or possibly $2\frac{1}{2}$ to 100. The addition of petroleum-oil emulsion to calcium arsenite sprays increased their eradicant properties (particularly of the 2 and 1 to 100 concentrations); whilst oil added in large quantities (4 per cent.) increased injuriousness to apricot trees; and Bordeaux mixture and zinc-lime, at concentrations of 8–4–100 or 4–2–100, decreased both the eradicant and the injurious effects of the lower concentrations of calcium arsenite, but affected only slightly the 4 to 100 concentration.

Zinc and sodium arsenite sprays were both inferior to calcium arsenite and the second of the two proved too injurious to trees when used in its most effective concentration.

Cultures made from blighted twigs sprayed with calcium arsenite showed that the mycelium of the fungus had been killed, probably by the water-soluble arsenic in the spray. Arsenite sprays applied to the trees after large numbers of sporodochia had developed were less consistently effective than were those applied earlier in the season. Thus, in 1938, calcium and zinc arsenite sprays (both at the rate of 3 lb. to 100 gals.) applied in February killed a high percentage of conidia borne on sporodochia; but in 1939, January sprays effectively destroyed the conidia then present, while February sprays killed only the outermost conidia, and did not penetrate deeper into the tightly packed mass of conidial chains. Lack of sufficient rainfall to liberate soluble arsenic is believed to be responsible for this low toxicity. Observations in experimental orchards showed that on the whole suppression of sporodochial development by arsenite sprays resulted in marked reduction in disease. Blossom infection was reduced by calcium arsenite sprays by 70 and 77 per cent. in 1938; 91 and 96 per cent. in 1939; and 85, 91, 97, and 98 per cent. in 1940. Results obtained with zinc and sodium arsenite were less consistent. Control of blossom blight obtained with calcium arsenite compared favourably with that obtained with Bordeaux mixture applications in spring or both calcium arsenite and Bordeaux treatments combined. However, the arsenite spray is not intended to replace but to supplement Bordeaux. Injury to the tree following arsenite sprays may develop from the entry of arsenic into wounds, leaf scars, buds, or dead twigs. In almond, which proved hypersensitive even to the lowest concentrations, arsenic may penetrate through uninjured bark. Apricots and the plum varieties tested were more tolerant, the former suffering injury only where high concentrations were used or the sprays applied soon after pruning or leaf fall. Concentrations of 2 and 3 lb. to 100 gals. seemed safe when applied in midwinter. Injury can be considerably reduced by delaying pruning till after spraying or by postponing it until midwinter when the leaf scars have healed.

JEFFERS (W. F.) & DARROW (G. M.). **Promising Strawberry crosses resistant to the red stele disease.**—*Trans. Peninsula hort. Soc.*, xxxi, 4, pp. 20–23, 1942.

Of some 10,000 strawberry seedlings tested in the past three years in a co-operative project between the United States Department of Agriculture and the University of Maryland for the production of varieties resistant to red stele [*Phytophthora fragariae*: *R.A.M.*, xxi, p. 86], about 2,300 were selected for resistance. Most of these have been tested for two years in soil in which susceptible varieties die, and 95 reserved for further testing. At the U.S. Horticultural Station, 18 of the selections found to be immune when experimentally inoculated were fruited in 1941, and four hybrids were selected as commercially promising, all being crosses between Aberdeen and Fairfax. Several thousand plants of these selections were propagated for further tests. Although many desirable hybrids have been obtained, it is thought that further breeding may produce even better selections.

Of particular interest among the hybrids kept for further experiment was a cross between a Scottish selection known as BK–46 and Fairfax. This, which proved to be a very good selection, does not have Aberdeen as a parent. Of interest also are Aberdeen × Mastodon selections, which are the first highly resistant ever-bearers that merit further testing. Several selections of Aberdeen × Blakemore almost equal Blakemore in quality. Of hybrids grown on the Eastern Shore the most promising are four crosses between Aberdeen × Fairfax and one between Aberdeen × Dorsett.

Miller (P. A.). **Phytophthora crown rot of Loquat.**—*Phytopathology*, xxxii, 5, pp. 404–409, 3 figs., 1942.

In 1939 two 11-year-old loquat trees, one of the Early Red and the other of the Advance variety, at the University of California, Los Angeles, were observed to be suffering from a crown rot attributable to spontaneous infection by *Phytophthora cactorum*, previously recorded as a pathogen of the same host in Japan but not hitherto described as a natural parasite of loquats in the United States [*R.A.M.*, xii, p. 594; xvii, p. 253]. Primary symptoms of the disease on the Early Red tree included the development on the bark of irregular, necrotic lesions, fuscous brown to fuscous black (Ridgway) on the surface and Prout's to mummy-brown beneath, followed at an advanced stage of infection by desiccation, cracking, and sloughing-off of the affected portions, while secondary features of the disease were the progressive yellowing and shedding of the foliage and the general decline of the tree. The brown streaking of the cambial region and the strong odour of fermentation of the diseased cortex characteristic of the loquat crown rot were also mentioned by Baines as associated with a collar rot of apples caused by the same fungus [ibid., xviii, p. 807].

*P. cactorum* was isolated by four different methods from the diseased loquat tissues, and pure cultures from potato dextrose agar inoculated with positive results into watermelon, apple, and quince fruits and loquat seedlings, the last-named developing typical cankers. Effective control was afforded by decortication in the early stages of the disease, removing the dead bark within the lesions and the sound cortex 1 to $1\frac{1}{2}$ in. beyond their margins, followed by the application with a brush to the treated areas of a wash consisting of $\frac{1}{2}$ oz. dry Bordeaux mixture in a pint of water.

McClellan (W. D.). **Temperature as it affects spore germination in the presence of copper and sulphur.**—*Phytopathology*, xxxii, 5, pp. 394–398, 1 graph, 1942.

At the New York (Cornell) Agricultural Experiment Station the writer observed the effect of temperatures between 6° and 33° C. on the toxicity of copper sulphate to the conidia of *Sclerotinia fructicola* and *Alternaria solani* and the uredospores of *Uromyces caryophyllinus* and of a proprietary particulate sulphur (Walco Products, Inc., 512 Greenwich St., New York) to the conidia of *S. fructicola*, *Venturia inaequalis*, and *Sphaerotheca pannosa* var. *rosae*. Both preparations were least effective against the several fungi at approximately the optimum temperature for the germination of their spores, a result agreeing with the conclusion of Clark (*J. phys. Chem.*, v, pp. 269–316, 1901) and Brooks (*Bot. Gaz.*, xlii, pp. 359–375, 1906). In practice, the time required for killing a pathogen at temperatures below the optimum for that organism would probably be longer than that required above the optimum and the toxic agent should usually be applied at the higher temperatures. In the case reported by Smith [*R.A.M.*, ix, p. 393] sulphur was effective in controlling *S. fructicola* on peaches at 40° to 55° F. but not at 65° to 85°, temperatures approximating the optimum for this fungus.

Parker-Rhodes (A. F.). **Studies on the mechanism of fungicidal action. II. Elements of the theory of variability. III. Sulphur.**—*Ann. appl. Biol.*, xxix, 2, pp. 126–135; 136–143, 1 diag., 1 graph, 1942.

In the second contribution to this series [*R.A.M.*, xxi, p. 150], the author defines variability as a parameter equal to the variance of the $\alpha$th power of the variate,

divided by the square of $\alpha$ and of the mean of the $\alpha$th power of the variate. It is mathematically expressed as $W_\alpha(x) = V(x^\alpha)/\overline{\alpha^2 x^{\alpha^2}}$, and it is deduced that $W_0(x) = V(\log x)$. The index of variation is defined as the quantity $\alpha$ in the definition of variability, cited; it is assumed that there exists a value of $\alpha$ such that the $\alpha$th power of the variate is normally distributed. The variability is estimated by a statistical equation, which refers to the tolerance of a given spore, defined as that concentration which just suffices to prevent that spore from germinating. On the basis of these mathematical equations, it is deduced that the variability of the tolerance of a given population of fungal spores is less to any permeative compound than to a non-permeative one of the same element, unless it undergoes one or more reactions on the surface of the spore with some constituents of the spore secretion, and the greater the number of such successive reactions that are required to bring it to permeable form, the greater the variability will be. It is further deduced that instability on the part of a given compound increases the apparent value of the variability of the spores to it; that the variability of the spores to any compound is proportional to the square of the number of atoms of the effective element in a molecule of that compound, and that the index of variation is inversely proportional to that number, provided only one compound is permeative; and finally, that the variability to a compound, which had undergone molecular dissociation into parts, some of them permeative, will be proportional to the number of parts into which it dissociates, and the index of variation inversely proportional to that number. It is believed that most kinds of synergism, occurring between constituents of a mixture used in experiments or between a compound under test and any product formed therefrom as a result of its toxic action, might interfere with the results by increasing the apparent value of variability.

The third contribution deals with the reaction of spores of *Macrosporium* [*Stemphylium*] *sarciniforme* to a selection of sulphur compounds (flowers of sulphur, sodium dithionite, sodium sulphite, sodium dithionate, sodium tetrathionate, sodium thiosulphate, and sodium sulphate), applied as spray solutions. Hydrogen sulphide was used in the form of mixtures with air, a geometrical series of which was prepared with the aid of a special apparatus. These mixtures were found liable to decomposition by atmospheric oxidation when brought into contact with water, the figures obtained indicating that the reaction follows an essentially unimolecular law. It is concluded from the results of this study that only certain sulphur ions (containing two sulphur atoms to the ion) can penetrate the spore wall of the fungus, e.g., hydrodisulphide, dithionite, and perhaps pyrosulphite, or if only one such ion is permeative, thiosulphite. Of the two isomeric forms, a yellow and a colourless one, presumed to exist in certain ions with two sulphur atoms, it is believed that only the latter can be absorbed. It is suggested that sulphur exerts its effect indirectly through the pyrosulphoxylate ion present in the hydrolysate. It is pointed out that the results do not depart significantly from the predictions of the theory of variability.

GUNESCH (W. E.). **Tear gas treatment of soil.**—*Canning Age*, xxiii, 5, p. 272, 1942.

Two drawbacks still attend the commercial use of chloropicrin for the control of plant pathogens in the soil [*R.A.M.*, xx, p. 582], one being the lack of a reliable machine for its application and the other the reluctance of growers to handle a preparation which is liable to cause a certain amount of discomfort to the inexperienced. These disadvantages, however, should not be allowed to outweigh the great utility of the chemical for the treatment of hot-bed, cold-frame, or outdoor plant-bed soils. Using $2\frac{1}{2}$ c.c. for each injection on 10 to 12 in. centres, about 420 lb. per acre is required. At the present price of 80 cents to \$1·25 per lb., the treatment of 1 sq. ft. of soil costs roughly 1·6 cents. The chemical reaches a depth of 4 to 8 in. The soil temperature must be maintained at upwards of 60° F. and the amount of moisture moderate.

Heuberger (J. W.) & Horsfall (J. G.). **Reduction in fungicidal value of copper compounds by organic materials.**—*Phytopathology*, xxxii, 5, pp. 370–378, 1942.

At the Connecticut Agricultural Experiment Station the writers conducted a laboratory study on the effects of various organic materials used as spreaders on the fungicidal value of copper sulphate, Bordeaux mixture, copper oxychloride, and red and yellow cuprous oxides.

Judged by their toxicity to *Macrosporium* [*Stemphylium*] *sarciniforme* [*R.A.M.*, xix, p. 665], the copper compounds were adversely affected at a uniform point (LD 50, representing the lethal dose for 50 per cent. of the spores) by materials containing substantial amounts of protein, e.g., derris and pyrethrum powders [ibid., xx, p. 488], soy-bean flour, and lucerne meal, whereas no deleterious action was exerted by activated charcoal and maize starch, the protein contents of which are negligible. The reduction in fungicidal value by protein-containing substances is tentatively attributed to a reaction between the toxic copper and the protein diminishing the amount of the former available for spore destruction.

Hyre (R. A.). **Relation of particle size to fungicidal value and tenacity of two 'insoluble' copper fungicides.**—*Phytopathology*, xxxii, 5, pp. 388–393, 1 fig., 1942.

In a laboratory study at the Tennessee Agricultural Experiment Station on the relationship of particle size to the fungicidal value and tenacity of four samples of copper carbonate and two of tri-basic copper sulphate, gauged by the toxicity of these compounds to the spores of *Macrosporium* [*Stemphylium*] *sarciniforme* [see preceding abstract], both the properties under investigation were found to increase *pari passu* with a decrease in the dimensions of the constituent particles [*R.A.M.*, xviii, p. 538; xxi, p. 341]. The mean Bordeaux coefficients of the coarse, medium, and fine fractions of copper carbonate, with particle sizes of 2·06, 1·17, and 0·83 $\mu$, respectively, were 0·160, 0·391, and 0·534, respectively, and the tenacity coefficients of the three fractions 0·393, 0·512, and 0·608, respectively, compared with 0·769 for Bordeaux mixture. For tri-basic copper sulphate with particle sizes of 4·07 and 2·54 $\mu$, respectively, the Bordeaux coefficients were 0·181 and 0·266, respectively, and the tenacity coefficients 0·301 and 0·507, respectively, compared with 0·842 for Bordeaux mixture.

Rangel (E. D.). **Contribuição para o glossário português referente á micologia e á fitopatologia.** [Contribution to a Portuguese glossary embracing mycology and phytopathology.]—*Rodriguésia*, iv, 12, pp. 67–116, 1939.

This revision of the author's glossary of Latin or Latinized mycological and phytopathological terms and their Portuguese equivalents embodies corrections and additions to the first list [*R.A.M.*, x, p. 743].

Brewer (J. H.). **A new Petri dish cover and technique for use in the cultivation of anaerobes and micro-aerophiles.**—*Science*, N.S., xcv, 2475, p. 587, 1 fig., 1942.

The new Petri dish cover described in this note for use in the surface cultivation of anaerobes and micro-aerophiles is so designed that most of the flat portion is depressed and touches the agar at the periphery, trapping a small amount of air over the agar surface. A reducing agent is added to the agar medium employed and this uses up the oxygen in this small amount of air, while the glass rim of the depressed portion of the cover forms a seal with the moist solidified agar.

Armitage (F. D.). **The rotting of the litho damping rollers.**—*Patra J.*, v, 5, pp. 83–86, 1942. [Abs. in *Bull. Inst. Pap. Chem.*, xii, 10, pp. 318–319, 1942.]

A species of *Sporotrichum* was found to be responsible for the rotting of the soft rubber, moleskin, and felt coverings of the damping rollers of an offset lithographic machine, the same fungus being also present in the new felt stocks examined. The rubber was very heavily infected and quickly contaminated any new felt and moleskin

coverings fitted on to the machine. Temporary control was effected by washing the rubber rolls with an aqueous solution of methyl para-hydroxybenzoate, but a complete removal of the rubber covering was eventually found to be necessary.

MUSHIN (ROSE). **Serological studies on plant viruses.**—*Aust. J. exp. Biol. med. Sci.*, xx, 1, pp. 59–63, 1942.

Using a modified form of Chester's precipitin titration technique [*R.A.M.*, xiv, p. 781], the author conducted at the University of Melbourne a serological study on the following 11 viruses: ordinary tobacco mosaic, tobacco aucuba mosaic, tomato bushy stunt, potato virus X, potato virus X+B (Bawden), potato aucuba mosaic, tuber blotch (Loughnane and Clinch) [ibid., xxi, p. 265], potato spindle tuber, tomato spotted wilt, rose wilt [ibid., x, p. 733], and strawberry crinkle, of which the two last-named and potato spindle tuber were propagated in their own hosts and the remainder in tomato.

Four of the viruses tested gave no precipitin reactions, viz., potato spindle tuber, tomato spotted wilt, rose wilt, and strawberry crinkle. The results obtained with the tobacco mosaic viruses, tomato bushy stunt, and potato virus X were in general agreement with those of other workers. The precipitin titre of the potato X+B complex was $\frac{1}{256}$, the corresponding figures for potato aucuba and tuber blotch being $\frac{1}{16}$ and $\frac{1}{4}$, respectively. Cross-precipitin tests showed that, of the viruses tested, only the two strains of tobacco mosaic were serologically related. Precipitin titres of tobacco aucuba mosaic and potato virus X in different parts of tomato plants indicated that the maximum concentration of both viruses resides in the leaves and lowest in the stems and petioles, the results in respect of the first-named agreeing with those of Matsumoto and Somazawa [ibid., xii, p. 598].

The different viruses were found to yield characteristic types of precipitates, those of the ordinary and aucuba mosaics of tobacco being abundant and light in texture, that of potato virus X still light in texture but less abundant, the floccules of potato aucuba mosaic rather coarser than those of X, and the particles of tomato bushy stunt tightly aggregated. The author agrees with Bawden and Pirie [ibid., xvii, p. 566] that the tomato bushy stunt floccules resemble those obtained with bacterial 'O' antigens, while the tobacco mosaic and potato virus X precipitates conform to the 'H' type and further suggests the inclusion in the latter group of potato aucuba mosaic.

Investigations on the field methods of precipitin testing devised by Chester [ibid., xvi, p. 767] and Dounin and Popova [ibid., xvii, p. 762] showed the former to be reliable when the optimum antigen-antibody flocculation ration was applied, while the latter yielded inconsistent results.

DODGE (B. O.). **A note on segregation types in Glomerella.**—*Mycologia*, xxxiv, 2, pp. 219–221, 1942.

The author suggests possible explanations of origin of 'light' and 'dark' races in *Glomerella* in the light of results recently reported for *Paramecium*.

DAINES (R. H.), CAMPBELL (J. C.), & MARTIN (W. H.). **Three years' comparisons of dusts and Bordeaux spray for Potato production in central Jersey.**—*Amer. Potato J.*, xix, 5, pp. 90–96, 1942.

Of the various plant protectives tested on Irish Cobbler potato crops during the period from 1938 to 1940 at the New Jersey Agricultural Experiment Station, New Brunswick, Bordeaux mixture 10–10–100 gave the best control of late blight [*Phytophthora infestans*], and in the phenomenally dry season of 1940 it also acted as an effective insect repellent. At the same time, the foliage of the plants treated with this preparation remained green longer than that of any of the others, although this effect was not reflected in an increased yield. In 1938, when both flea-beetles [*Epitrix*

*cucumeris*] and late blight were severe, the Bordeaux-sprayed plots outyielded those treated with 30–70 copper-lime dust (469 and 446·3 bush. per acre, respectively); in 1939, a season of severe insect infestation, the copper-lime dust treatment was more effective (191·1 bush. per acre compared with 171·3 for Bordeaux mixture) and in 1940 the yields in both series of plots were approximately equal.

NATTRASS (R. M.). **Potato blight.**—*E. Afr. agric. J.*, vii, 4, pp. 196–201, 4 figs., 1942.

The climatic conditions prevailing in Kenya, where potato blight (*Phytophthora infestans*) was first observed in 1941, permit of continuous cultivation of the host in one stage or another, so that the problem of the overwintering of the pathogen does not arise. Kerr's Pink, the favourite variety in the colony, is reputed to be fairly resistant to blight, but it sustained heavy damage in the 1941 epidemic; certain 'native' varieties, such as Nyakinongo and Kiraya, withstood the disease much better, but others, e.g., Misimaa and Nyakahoro, are highly susceptible and should be excluded from the vicinity of the main crop, since they might well constitute the focus of an attack. Directions are given for the preparation of Bordeaux and Burgundy mixtures, of which the latter will probably be preferred for use in the Colony, where good-quality lime is not easily obtainable.

WHITE-STEVENS (R. H.). **Boron deficiency on Long Island.**—*Bett. Crops*, xxvi, 2, pp. 6–9, 42–46, 6 figs., 1942.

Following a general discussion on the effects of boron deficiency on plants, with special reference to Long Island soil conditions, the writer cites some data obtained in experiments on the amelioration of the disorders resulting from this shortage in particular crops. Swedes suffering from brown heart [*R.A.M.*, xx, p. 518] were found to require 20 lb. borax per acre for the control of the disease, while up to 50 lb. could be given with safety. Over a three-year average the percentages of brown heart in the check plot and those receiving 1, 5, 10, and 20 lb. borax per acre were 72, 38, 9, 6, and 4, respectively, the corresponding figures for black canker in beets [ibid., xxi, p. 114] being 33, 23, 13, 11, and 9 respectively, and for hollow heart in cauliflowers [ibid., xxi, p. 113], 65, 32·1, 17·1, 3·3, and 0·7, respectively. In connexion with the last-named disease, the soil reaction was found to play an important part in determining the extent of the damage from boron deficiency, which was estimated (by means of a grade index, 0 = no injury) at 0·44, 0·40, 0·40, and 0·20 in plots receiving borax at $P_H$ 4·7 to 5·0, 5·0 to 5·5, 5·5 to 6·0, and 6·0 to 7·1, respectively, the corresponding figures for the untreated controls being 2·8, 1·9, 1·4, and 0·9, respectively. Since potatoes require only small amounts of boron and suffer from its excess, the cauliflower crops preceding them (the usual local rotation) should be treated as conservatively as possible.

ORSINI (G.). **A bacterial soft rot of Capsicum fruits.**—*Int. Bull. Pl. Prot.*, xxxiii, 3, pp. 33M–36M, 1942.

In November, 1939, a field of *Capsicum annuum* plants at Todi, Perugia, showed the presence of a bacterial soft rot. The disease attacked the pods at any stage of ripening and in any part, usually the base of the peduncle. In a few days the whole fruit was affected, and a dense, viscid, evil-smelling liquid accumulated in the tip. Affected unripe pods showed an olive-brown spot which spread through the entire healthy tissue in eight or nine days; on ripe, yellow or red pods, the infected area showed softening but no colour change.

The parenchymatous tissue broke down into a shapeless, soft mass, while the epidermis remained unaffected, but stretched under the weight of the liquid accumulated in the tip of the fruit, which assumed the shape of an inverted cone. Later, the epidermis became ruptured, and the liquid was discharged, frequently infecting pods lower down. The liquid contained myriads of very mobile bacteria measuring 1 to

1·5 by 0·3 to 0·5 $\mu$, and almost in pure culture. This liquid, extracted with a syringe from the interior of a fruit having an intact epidermis, when inoculated into a sound fruit, reproduced the disease in four to five days. The organism differed entirely from *Bacillus coli* var. *capsici* Passalacqua, *B. capsici* Pavarino & Turconi, and *Bacterium vesicatorium* [*Xanthomonas vesicatoria*] and could not be considered identical with *Bact. briosii*. It showed, however, some affinity with *Bact.* [*Pseudomonas*] *syringae*, of which the author considers it to be a new variety which he names *Bact. syringae* var. *capsici* n. var. [without a diagnosis], chiefly characterized by its non-pathogenicity to lemon, lilac, and pear.

Three seasons' observations indicated that attack occurs in autumn after a cold wet spell. The best means of control would appear to consist in harvesting the last crop when the autumn rains start, even if the pods are not ripe, provided they fulfil trade requirements. All diseased fruits and crop trash should be burnt.

MÜLLER (A. S.) & TEXERA (D. A.). **La mancha blanca del Ajanjoli.** [The white spot of Sesame.]—*Agricultor venez.*, v, 57–58, pp. 47–49, 3 figs., 1941.

The white to grey, sharply delimited spots, 1 to 2 mm. in diameter, produced by *Cercospora sesami* on sesame foliage and pods [*R.A.M.*, xx, p. 450; xxi, p. 44] in Venezuela number 100 to 400 per leaf. Under humid conditions, such as prevail in the States of Aragua, Carabobo, Miranda, and Distrito Federal, the disease may assume a severe character, involving premature defoliation and reducing the yield of seed. In trials at the El Valle Agricultural Experiment Station, the plants raised from seed sown on 15th September, 1939, were sprayed four times at monthly intervals with bordinette [ibid., xvii, pp. 486, 685] at the rate of 1 kg. per 100 l. In counts made during January, 1940, the numbers of spots on the large, medium-sized, and small leaves were 50, 10, and 6, respectively, the corresponding figures for the controls being 170, 75, and 25, respectively.

BISBY (G. R.), MASON (E. W.), & WAKEFIELD (E[LSIE] M.). **A note on nomenclature.**—*Mycologia*, xxxiv, 2, pp. 215–217, 1942.

This paper refers to the nomenclatural results of the discovery that S. F. Gray's 'Natural arrangement of British Plants' is later than Volume I of Fries's Systema. The start of nomenclature of 'fungi caeteri' from the date of publication in Systema I, II, and III is favoured instead of the proposal to start with 1st January, 1821.

MACMILLAN (H. G.) & PLUNKETT (O. A.). **Structure and germination of Septoria spores.**—*J. agric. Res.*, lxiv, 10, pp. 547–559, 2 pl., 1942.

A study of the spores of *Septoria apii-graveolentis* [*R.A.M.*, xviii, p. 780] from cultivated and escaped celery, the results of which have a bearing on the structure of other species of this genus, showed that the spores are mature when they consist of four cells, and are three-septate. The term 'septate' is here used to imply septation in the spores of this fungus caused by the abutting plasma membranes of contiguous cells within the integument, no true septa being present; this is shown by heating and drying the spores when the protoplasts draw away from each other and from the spore wall. Spores with five or seven septa were occasionally found, but spores with an even number of septa were abnormal. Germination of the spores is accompanied by cell proliferation, usually by division of the end cells of the spores. The appearance of the cell contents was observed to change with progressive stages of germination, larger globules developing apparently as a result of agglutination of the original smaller ones. The term 'guttula', as encountered in descriptive mycological literature, is determined in the case of the *Septoria* spores as 'bright spots produced by lens action on the clear portions within the cells of the spore'; it is not considered a safe basis for specific differentiation.

The examination of a number of fungi now regarded as species of *Septoria* leads the authors to believe that those characterized by shorter and wider spores and with one

or two septa are probably misclassified. It is pointed out that observations on spores of species of *Septoria* made in the bright field of the microscope are not sufficient, and that the spore structure is revealed more completely in the dark field.

Padwick (G. W.). **The genus Fusarium. VI. A recent attempt at mass revision.**—*Indian J. agric. Sci.*, xi, 5, pp. 663–674, 1941.

The author reviews the history of the sections *Elegans*, *Lateritium*, and *Liseola*, and is especially concerned with the fate of the species as proposed in Snyder and Hansen's 'The species concept in *Fusarium*' [*R.A.M.*, xix, p. 495]. These authors regard all the so-called species of the section *Elegans* as one species, but at the same time consider the major grouping of the species into sections to be correct. Dr. Padwick does not accept either conclusion. He holds that species should not be studied merely *in vitro* and in pathogenicity tests, and thinks a new taxonomy can only safely be based on field work directed to establishing species with an ecological and even geographical distribution.

Mrak (E. M.), Phaff (H. J.), & Smith (B. L.). **Non-validity of the genus Asporomyces.**—*Mycologia*, xxxiv, 2, pp. 139–141, 1942.

The imperfect yeast genus *Asporomyces*, originally described by Chaborski and tentatively retained by Ciferri and Redaelli [*R.A.M.*, viii, p. 677] and by Lodder [ibid., xiv, p. 193] in their keys to the family Torulopsidaceae, is considered invalid on the following grounds. The formation of abortive conjugation tubes, which was given as the main diagnostic character of the genus, was observed in a number of other yeasts and is apparently not restricted to a single genus or family. Nor is it considered a reliable morphological character, as it does not appear to occur regularly or under a given set of conditions. It is concluded, therefore, that the genus *Asporomyces* is no longer acceptable even in a tentative manner. *A. uvae*, described by Mrak and McClung, should be transferred to *Torulopsis pulcherrima* as suggested to the authors by T. Hof. The true identity of the type species, *A. asporus* [loc. cit.], which was lost and is therefore not available for comparison, remains doubtful, but its fermentation characters are stated to be similar to those of *T. californicus*. A revised version of Lodder's generic key to the Torulopsidoideae is given.

Jenkins (Anna E.) & Bitancourt (A. A.). **Myriangiales selecti exsiccati, Fascicle 1.**—*Mycologia*, xxxiv, 2, pp. 214–215, 1942.

In a short note on this fascicle, issued from São Paulo in 1940, the authors state that it is based on a previous paper by themselves [*R.A.M.*, xix, p. 366]. It contains 50 specimens, issued in 10 sets, all of which, with the exception of two bearing the date 1925, were collected between 1931 and 1940 in South America. Two sets have already been deposited in the Farlow Cryptogamic Herbarium and the herbarium of the New York Botanical Garden.

Karling (J. S.). **A synopsis of Rozella and Rozellopsis.**—*Mycologia*, xxxiv, 2, pp. 193–208, 1942.

Following the recent critical discussion of the genus *Rozella* and the erection of the new genus *Rozellopsis* [*R.A.M.*, xxi, p. 351], the author presents a complete list of known species of these two genera, which at present number fifteen in the first and four in the second. The following parasitic species are of interest: *Rozella irregularis* on *Pythium vexans* and *P. monospermum*; *R. cuculus* on *Pythium* sp., *P. intermedium*, and *P. monospermum*; the two new species, *R. laevis* on *P. gracile*, and *R. barrettii* on *Phytophthora cactorum*; *Rozellopsis inflata* on *Pythium intermedium*; and *R. waterhouseii* on *Phytophthora cryptogea* and *P. megasperma*.

LANGE (J. E.). **Flora agaricina danica. Vols. I–V.** [Danish agaric flora. Vols. I–V.]—550 pp., 200 col. pl., Copenhagen, Recato A/S, 1935–1940. Kr. 400.

This work, described by the editors as 'a new standard iconography of Agarics', has been issued under the joint auspices of the Society for the Advancement of Mycology in Denmark and the Danish Botanical Society, and comprises chromolithographic plates illustrating some 1,200 species, reproduced from the author's original paintings, now in possession of the Botanical Museum of the University of Copenhagen, accompanied by a set of keys and full descriptions of the morphological characters of the fungi under discussion.

ALLARD (H. A.). **Infectivity of extracted, unpreserved Tobacco mosaic virus retained 28 years.**—*Science*, N.S., xcv, 2471, p. 479, 1942.

A portion of tobacco mosaic virus filtered through filter paper was kept in a tightly corked vial on a shelf at room temperature from 1914 until 1936, when it was found to be as infectious as when first extracted. In 1942, it was again tested, by inoculation into 20 small Connecticut Broadleaf [tobacco] plants, being rubbed on the glandular trichomes of the leaves on 27th February. The first symptoms appeared on 7th March on nine plants, and the remainder showed mosaic on 9th March. The $P_H$ of the virus in 1942 was ascertained to be 6·76. Dried and ground leaf material obtained from affected tobacco in 1915, and stored in a jar at room temperature was no longer infectious in 1936.

The author's observations indicate that the retention of virulence of extracted, unpreserved sap depends upon the type of fermentation that occurs in the infected material, one type resulting in acid conditions being destructive to the virus and the other with a near neutral reaction favouring prolonged virulence.

BERKELEY (G. H.). **Tobacco mosaic in Ontario and Quebec.**—*Sci. Agric.*, xxii, 8, pp. 465–478, 1942.

The results of investigations conducted from 1935 to 1939 in Ontario and Quebec, Canada, showed that contaminated soil and smoking or chewing of tobacco by the workers while handling the growing crop of tobacco, are the most important primary sources of infection with the virus of tobacco mosaic [*R.A.M.*, xix, p. 371]. The virus was shown to overwinter in the soil and to infect the crop of the following year. Thus, 17 per cent. infection occurred in the plot where tobacco followed tobacco whereas none was observed on new ground; only 2 per cent. developed on the plot from which the tobacco plants of the previous year were pulled up instead of ploughed under. The survival of the virus in the soil was more pronounced in Ontario than in Quebec, where as little as 0·5 to 2 per cent. infection was observed in fields after crops having as much as 40 to 50 per cent. mosaic. The virus was readily recovered in quantity from samples of contaminated Ontario soils each month from October to July inclusive during two seasons, but none was obtained from Quebec soils after November in the first season and only in small amounts up to May in the second. The reason for better survival of the virus in Ontario soils is as yet obscure. The results of four years' tests indicated that it is unsafe to replace rogued mosaic plants with healthy ones as the latter contracted from 11 to 72 per cent. infection. Tobacco plants grown in soil into which infected trash had been incorporated showed between 30 and 55 per cent. infection, while none developed on soil that had not grown tobacco for two years.

High percentages of infection (up to 100 per cent.) resulted from transplanting with unclean hands after handling infected material or when tobacco was smoked or chewed during the operation. As much as 6 per cent. infection was observed when manufactured cigarettes were smoked and from 4 to 88 per cent. when the workers rolled their own cigarettes. Little or no infection occurred when the hands were thoroughly washed with soap under running water or in a solution of trisodium phos-

phate [ibid., xx, p. 498]. The presence of as few as 10 diseased among 200 transplanted seedlings resulted in 75 per cent. infection, indicating that a small amount of infection in the seed-bed may give rise to comparatively high incidence in the field. Roguing following three cultivations reduced the infection in the field from 40, 66, and 94 per cent. to 4, 10, and 19·9, respectively. Infection was increased by cultivation from 2 to 68 per cent. When rows of healthy plants were cultivated immediately following rows of infested ones, they contracted 4 per cent. infection under dry conditions, but as much as 75 per cent. when the plants were heavy with dew. In a similar test, 2 per cent. infection followed cultivation in dry, sunny weather, and 30 per cent. in rain. When plants were topped indiscriminately in the row, percentages of infection ranged from 7 to 78, whereas when all healthy plants were topped first, leaving diseased ones for later, infection was reduced to from 3 to 36 per cent.

The following conclusions are drawn for the control of tobacco mosaic: soil for seed-beds should be sterilized and only clean seed used; hands, clothing, and tools should be cleansed thoroughly before handling seedlings and no tobacco should be chewed or smoked while working; tobacco should be rotated with some other crops such as rye; roguing of diseased plants should be undertaken before each cultivation, which should preferably be carried out under dry conditions; and healthy plants should be topped before diseased ones.

Hill (A. V.) & Allan (F. E). **Yellow dwarf of Tobacco in Australia. III. Occurrence and effect of agronomic practices.**—*J. Coun. sci. industr. Res. Aust.*, xv, 1, pp. 13–25, 1 graph, 1 map, 1942.

In this further account of studies on tobacco yellow dwarf in Australia [*R.A.M.*, xx, p. 604] it is stated that the disease occurs in southern Queensland, New South Wales, Victoria, and South Australia, but has not been reported from Western Australia, Tasmania, or the northern and coastal districts of Queensland. In Victoria and the Tamworth area of New South Wales it is economically important every year.

An examination of the weather conditions prevailing in the different areas concerned failed to show any outstanding differences in temperature and rainfall that might help to explain differences in prevalence. However, dry hot conditions during and following transplanting appear to favour spread and the early development of symptoms. Small, rapidly growing plants appear to be highly susceptible, and symptoms may be more clearly defined after showery weather than at other times. Infection may occur at any growth stage, but losses are highest when the plants are attacked shortly after transplanting.

Five years' observations in different districts indicated that source of seed does not affect the amount of disease in the field. Some varietal differences in susceptibility were observed, but were peculiar to localities and seasons and there was no indication that any variety was inherently less susceptible than others. Seed-bed infection did not appear to be important. No significant effects on incidence were attributable to fertilizer treatments or soil type. In general the greatest differences in percentage infection were between different districts in any one season, and between different seasons. In some seasons, early- and late-planted crops are less affected than the rest, probably because the early ones have grown sufficiently to resist the worst effects of the disease, and because the late ones escape attack. The chief infective period does not occur at the same time every year; in 1939–40 it was in December, but in several other years in November. After the main infective period is over, comparatively few plants are attacked. Time of planting cannot, however, be relied upon as a means of avoiding infection, but the available evidence suggests that late-planted crops are usually less affected than early-planted ones. It might be practicable to develop an early-maturing variety that could be planted late enough to escape the worst infection period.

Rawlings (R. E.). **Observations on the cultural and pathogenic habits of Thielaviopsis basicola (Berk. & Br.) Ferraris.**—*Ann. Mo. bot. Gdn*, xxvii, 4, pp. 561–598, 3 pl., 10 graphs, 1940.

The author describes in detail the cultural and morphological characteristics of three isolates of *Thielaviopsis basicola*: A from tobacco, Tennessee, B from *Primula obconica*, Holland [*R.A.M.*, xii, p. 513], and C from cotton, Texas. These were found to be distinct physiologic races: A was strongly pathogenic to tobacco, groundnuts, and watermelon, but less so to cotton and *Primula obconica*; B severely damaged watermelon, attacked cotton more and *Primula obconica* and groundnuts less strongly than A, and failed to infect tobacco; C was only weakly pathogenic to cotton, groundnuts, and watermelon, and unable to infect tobacco and *Primula obconica*. A was quite constant in culture, C extremely variable, and B intermediate. Chlamydospore production by A was materially reduced at $P_H$ 7 and 8 whereas B and C were only slightly affected. The endospores of A were smallest (11·9 by 4·2 $\mu$), B the largest (15·6 by 4·7 $\mu$), and C intermediate (13·9 by 4·3 $\mu$). The chlamydospore chains of A were often borne in large clusters, those of B in groups of 1 to 3, and those of C singly or in pairs. The chlamydospores of A averaged 7·6 $\mu$ in length, B 9·0 $\mu$, and C 7·5 $\mu$.

Diachun (S.), Valleau (W. D.), & Johnson (E. M.). **Relation of moisture to invasion of Tobacco leaves by Bacterium tabacum and Bacterium angulatum.**—*Phytopathology*, xxxii, 5, pp. 379–387, 2 figs., 1942.

Trials were carried out at the Kentucky Agricultural Experiment Station to determine the capacity of *Bacterium tabacum* [*Pseudomonas tabaca*] and *Bact. angulatum* [*P. angulata*] on the surface of moist Burley tobacco leaves to infect the foliage in the absence of water-soaked tissue.

No infection occurred either in the greenhouse or field when a suspension of *P. tabaca* was placed on the leaf surfaces; that is to say, the bacteria did not swim through the stomata to attack the underlying tissues. Positive results were obtained, however, by the application, even for periods of a few minutes, of suspensions of both organisms to the surface of water-soaked foliar tissues, as well as by pouring the inoculum on to the surface of leaves previously sprayed (but not water-soaked) with sterile water. No infection resulted if the inoculum was applied after water-soaked tissues had lost the water-soaked condition. These results are interpreted as implying the dependence of bacterial infection of tobacco on the existence of open stomata and a liquid passage between the outer leaf surface and the intercellular tissues, in the absence of which forcible injection of the organisms through the stomata is essential to successful invasion [*R.A.M.*, xix, pp. 124, 440.] The excess internal liquid may or may not be sufficient to induce water-soaking and it need only be present for a few minutes. These conditions are not satisfied with every rain and unless they are infection does not occur even in the presence of the pathogens on the leaves.

Hochapfel (H.). **Die Wurzelphloemnekrose der Tomate.** [Tomato root phloem necrosis.]—*Zbl. Bakt.*, Abt. 2, cii, 10–11, pp. 262–269, 4 figs., 1940.

Observations in 1935, 1938, and 1939 on a phloem necrosis of outdoor tomato roots, causing appreciable losses in nurseries in the Breslau district of Germany, indicate that the adverse effects of low soil and atmospheric temperatures are primarily responsible for the disorder, the presence of *Colletotrichum atramentarium* on the diseased material being without etiological significance. The condition, which may develop either before or after transplanting, involves the outer phloem ring, especially the medullary ray and inner bark parenchyma, the resulting necrosis impeding the exchange of nutrients between the xylem and phloem. Generally speaking, the external symptoms of ‘chilling’, i.e., wilting and death of the plants, do not become apparent until June or July, so that the histological disturbances remain latent for a period of one to three months. Growers are advised to protect the seedlings thoroughly

against cold in the greenhouse and frame, and not to transplant them until the soil temperature rises above 5° C.; in 1938 the mean minimum for May was only 3·8°.

Cox (C. E.). **The performance of the Pan America Tomato on Fusarium wilt infested soil.**—*Trans. Peninsula hort. Soc.*, xxxi, 4, pp. 84–85, 1942.

In a test carried out in Maryland in 1941, the Pan-America tomato resistant to wilt (*Fusarium bulbigenum* var. *lycopersici*) [*R.A.M.*, xx, p. 607; xxi, p. 393] was grown with the Rutgers and Brown's Special varieties in a plot which had grown tomatoes in four of the past five years but which, because of the disease, had failed to produce a profitable crop during that period.

The first count made on 6th August revealed that Pan-America had a stand of 91·1 per cent., with no plants showing wilt symptoms, Rutgers one of 77·5 per cent., with 7·1 per cent. wilt, and Brown's Special one of 74·4 per cent., with 56·7 per cent. wilt. At the final count, on 11th September, Pan-America showed 90·7, Rutgers 73·8, and Brown's Special 56·9 per cent. stand. The yield of marketable fruit for the three varieties was 2·93, 3·73, and 1·07 tons per acre, respectively, many fruits of Pan-America failing to reach marketable size. In a garden on the same farm 152 Pan-America plants growing under better conditions yielded at the rate of 18·5 tons per acre of marketable fruit.

Pan-America appears to be more resistant to wilt than any other commercial variety at present available. The fruit produced in the test was of excellent quality but rather smaller than that of the commonly accepted varieties used locally for canning.

Moore (W. D.). **Some factors affecting the infection of Tomato seedlings by Alternaria solani.**—*Phytopathology*, xxxii, 5, 399–403, 1942.

Humidity was found to be the principal factor affecting the incidence of tomato leaf spot (*Alternaria solani*) infection in Georgia, where large-scale production of seedlings for transplantation to the north is carried out [*R.A.M.*, xix, p. 440], the number of hours per diem in which the atmosphere approaches saturation being apparently of more importance than the daily mean relative humidity over any given period. Under such conditions the amount of infection increases with rising mean temperatures (within the ranges of 54° to 62° and 74° to 82° F. in these experiments), though appreciable damage may occur in much cooler weather than that represented by the ordinary daily mean for the Tifton area of southern Georgia.

In 1937, 1938, and 1940, when field infection by *A. solani* was mild, the number of days and the mean number of hours per day with upwards of four hours of 90 to 100 per cent. relative humidity ranged from 3 to 8 and 6·5 to 9·3, respectively, in March (20th to 31st), 14 to 18 and 6·7 to 8, respectively, in April, and 5 to 10 and 5 to 7·6, respectively, in May (up to 20th), whilst in 1939, which was marked by a severe epidemic, the corresponding figures for March were 11 and 11·6, for April 25 and 10·8, and for May 19 and 10·2, respectively.

Both the leaf spot and stem canker phases of the disease are liable to be intensified by the unavoidable mechanical injuries incidental to the processes of pulling and packing the seedlings while the humid atmosphere induced in the crates by the wet peat moss used for transport is likewise conducive to the spread of infection.

Beattie (J. H.), Beattie (W. R.), & Doolittle (S. P.). **Production of Tomatoes for canning and manufacturing.**—*Fmrs' Bull. U.S. Dep. Agric.* 1901, 15 figs., 1 map, 1942.

The section of this bulletin (superseding No. 1233 in the same series) on tomato diseases and their control comprises popular notes on a number of well-known disorders of the crop and their preventive or curative treatment.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
OF
# APPLIED MYCOLOGY

VOL. XXI OCTOBER 1942

COOK (C.). **Some aspects of tree surgery in Canada.**—*Ann. appl. Biol.*, xxix, 2, pp. 205–208, 1942.

A plea is made for training tree surgeons and employing them on a municipal basis. Much harm is stated to be done to trees in Canada by unskilled men. A tree surgeon's work is outlined and methods given of climbing trees, pruning, cabling, filling cavities, and spraying against pests and diseases.

ZENTMYER (G. A.). **Toxin formation by Ceratostomella ulmi.**—*Science*, N. S., xcv, 2472, pp. 512–513, 1942.

Experiments carried out at the Connecticut Agricultural Experiment Station since 1940 have demonstrated that *Ceratostomella ulmi* [*R.A.M.*, xxi, p. 231], when grown in culture on a liquid nutrient solution containing yeast extract, produces a soluble toxic substance [cf. ibid., vi, p. 518], which is evidently the primary factor in the production of Dutch elm disease symptoms.

Toxicity was tested by filtering off the fungus after 12 to 25 days' growth, injecting the sterile filtrate into small American elms, and testing its effect on various plant cuttings. When the toxin was injected into healthy elm seedlings, typical symptoms of Dutch elm disease resulted. Young leaves wilted and died, older leaves curled upwards or developed necrotic spots, all walls were discoloured for long distances from the point of injection, and dark gums plugged the vessels. Tomato, elm, snapdragon [*Antirrhinum* sp.], and maple cuttings placed in tubes containing the filtrate from fungus cultures wilted severely, generally in one to four hours. Uninoculated nutrient solution failed to affect elm trees or plant cuttings, while control solutions adjusted to the $P_H$ of the fungus filtrate also had no effect.

When filtrate from a 25-day-old culture was injected into five potted elms and ten 3 to 4 ft. tall in nursery rows, the symptoms described above appeared on all in three days. On five trees injected with 75 c.c. of filtrate 20 per cent. of the leaves were killed, on an average, and the height of discoloration of the wood averaged 24 in. above the point of injection; the corresponding figures for five trees injected with 200 c.c. of filtrate were 29 per cent. and 29 in. Slight toxin formation was found after three days' growth of the fungus, production reaching a maximum after 12 days' incubation. Toxin production was closely related to the growth vigour of the culture.

The toxin was not enzymatic, was adsorbed by activated charcoal, was removed from aqueous solution by an excess of toluene, and was 'antidoted' by several organic chemicals. The possibility of controlling Dutch elm disease by chemotherapy is suggested.

BUCHANAN (W. D.) & SMUCKER (S. J.). **Reactivation of Ceratostomella ulmi in occluded infections and contamination of Scolytus multistriatus.**—*J. econ. Ent.*, xxxv, 2, pp. 178–180, 1942.

When adults of the elm bark beetle *Scolytus multistriatus* were allowed to feed under controlled conditions on 229 *Ulmus americana* trees with occluded infections of

*Ceratostomella ulmi* [*R.A.M.*, xxi, p. 273] at Morristown, New Jersey, no conclusive evidence was obtained of the reactivation of the fungus through feeding injuries inflicted by 11,400 beetles. The pathogen was isolated from four out of 529 insects collected while feeding in the twig crotches and trunks of the same trees, but not from those occupying any of the 230 oviposition galleries removed from uncontaminated trap logs. Three out of 234 beetles taken while feeding in the twig crotches of trees with a current infection also yielded *C. ulmi*, which was further recovered from three out of 15 collected from oviposition galleries in course of construction in a tree having both an occluded (one- and two-year-old) and an active infection.

Urquijo Landaluze (P.). **Nuevo metodo de lucha contra la 'tinta' del Castaño.** [A new method of control of the 'ink disease' of Chestnut.]—*Bol. Pat. veg. Ent. agric., Madr.*, x, pp. 15–32, 7 figs., 1941.

The essential features of the writer's method of combating the ink disease of chestnuts (*Phytophthora cambivora*) by decortication and the treatment of the exposed surfaces with copper oxychloride or copper carbonate, now practised on a wide scale in Spain, have already been noticed from another source [*R.A.M.*, xxi, p. 354].

Davis (S. H.). **An effective control for leaf blight of English Hawthorn.**—*Bull. Morris Arbor. Univ. Pa*, iv, 1, p. 11, 2 figs., 1942.

For some years past an English hawthorn (*Crataegus oxyacantha* [var. ] *rosea-plena*) outside the Morris Arboretum, Philadelphia, has been heavily infected by leaf blight (*Entomosporium thuemenii*) [cf. *R.A.M.*, vii, p. 99]. The fungus has caused an annual defoliation of all the trees of this species in the vicinity, the boughs becoming leafless before the first of September. In 1941, the tree in question was sprayed with Bordeaux mixture (4–4–50) at bud break (16th April), and the treatment was repeated on 22nd and 30th April. On 1st October, the tree was still bearing good, though rather spotted foliage, while the others in the vicinity were almost leafless.

Terrier (C. A.). **Über das Auftreten der Rhabdocline-Douglasienschütte in der Schweiz.** [On the occurrence of the *Rhabdocline* needle-fall of Douglas Firs in Switzerland.]—Reprinted from *Schweiz. Z. Forstw.*, *1942*, 1, 5 pp., 1942.

*Phaeocryptopus gaeumanni* is so widespread on Douglas firs in Switzerland [*R.A.M.*, xvii, pp. 638, 714] that its detection in 1941 in a nursery near Lausanne occasioned no surprise, whereas the presence of *Rhabdocline pseudotsugae* on the same needles was quite unexpected, this formidable pathogen not having been previously recorded (according to E. Gäumann) south of the Main. Presumably the latter fungus was introduced into Switzerland on the trees, which were procured in 1933 as three-year-old plants from Schleswig-Holstein (Germany). Before the discovery of *R. pseudotsugae* on the Douglas firs, a consignment had been dispatched to Dielsdorf, near Zürich, so that two foci of infection now exist in Switzerland. The writer takes this opportunity to recapitulate the outstanding features of the symptomatology, morphology, pathogenicity, geographical distribution, mode of spread, and control of *R. pseudotsugae*.

Sangster (R. G.). **The durability of some Uganda timbers and poles in the ground. Parts I and II.**—*E. Afr. agric. J.*, vii, 3, pp. 122–126; 4, pp. 208–211, 1942.

On the basis of preliminary tests extending over a period of 4 to $5\frac{1}{2}$ years under very exacting conditions in a clearing on deep red clay soil with a black humus surface layer at an altitude of 3,600 ft. near the Budongo Forest Station, Uganda, with a mean annual rainfall of 60·52 in., and a temperature range of 11° to 30° C., the woods recommended for large-scale constructional purposes in parts of the Protectorate having a similar climate are *Albizzia coriaria*, *Chlorophora excelsa*, *Cynometra alexandri*, *Erythophleum guineense*, and *Mildbraediodendron excelsa*, none of which showed more than 4 per cent. failures due to [unspecified] fungal rot and/or termites in four years.

The following species merit trial for the provision of poles for native dwellings, small temporary buildings, and the like. *A. zygia*, *Combretum binderanum*, *C. gueinzii*, *Dalbergia monoxylon*, *Hexalobus monopetalus*, *Hymenocardia acide*, *Lasiodiscus mildbraedii*, *Markhamia platycalyx*, *Teclea nobilis*, *Terminalia brownii*, and *Zizyphus mauritania*. Some of the weaker timbers, e.g., *Maesopsis eminii*, responded favourably to preservative treatment by boiling in creosote and paraffin (1:1). *Celtis zenkeri* (untreated) should prove suitable for telegraph poles or comparatively heavy temporary structures.

LINDGREN (R. M.). **Temperature, moisture, and penetration studies of wood-staining Ceratostomellae in relation to their control.**—*Tech. Bull. U.S. Dep. Agric.* 807, 35 pp., 4 pl., 4 graphs, 1942.

Significant differences in reaction to temperature were found to exist among eleven isolates of *Ceratostomella* [*R.A.M.*, xxi, p. 175] on malt agar, including seven cultures of *C. pilifera* of varying geographical origin, *C. coerulea* from Canada and Sweden, *C. pluriannulata*, and *C. ips*. The *C. pilifera* isolates fell into two distinct groups differing from 2° to 4° in optimum and maximum temperatures for growth. The approximate critical points for the low-temperature group of this species and of the Canadian isolate of *C. coerulea* lay at 3°, 25° to 26°, and 31° to 34° C.; and for the high-temperature group and *C. pluriannulata* at 4°, 27° to 29°, and 34° to 35°. *C. ips* failed to grow at 50°, made fairly rapid growth at 35°, and had cardinal points varying 2° to 8° above those of the other isolates. In all cases an increase of 5° to 8° above the optimum resulted in inhibition of growth, whereas a decrease of 5° to 8° below the optimum never reduced growth more than 40, and usually not more than 25 to 30 per cent., a drop of 20° or more being required to inhibit growth completely. Daily growth increments at a given temperature were not constant for any of the fungi, but neither was there any indication of a definite periodicity in rate of growth, or a determinable increase or decrease in rate of growth with time. The time of appearance of brown hyphae and the rate of change from hyaline to brown varied with the different isolates and temperatures. Brown hyphae appeared earlier and the change from hyaline to brown in hyphae of a given age was more rapid at temperatures near the optimum point. A direct correlation was found to exist between cardinal temperatures for growth in culture and viability of the isolates at unfavourably high temperatures. Loss of viability occurred relatively early at temperatures only slightly higher than the maximum points for growth: for *C. coerulea* and both groups of *C. pilifera* after 7 or 14 days at 35°, for all isolates except *C. ips* after two days at 40°, and for *C. ips* after 7 days at 40°. Daily changes of temperature between the near-minimum and near-optimum points (5° to 30°) for growth had no effect on the development of *C. pilifera* and *C. ips*. Both organisms appeared to adjust themselves immediately to the new thermal conditions and continued to grow at a normal rate for that temperature. But when the cultures were subjected for one day to temperatures slightly above the maximum points for growth (35° and 40°, respectively), increment was retarded for about two days.

The reaction of *C. pilifera* to different temperatures on surfaces of *Pinus echinata* wood was in general the same as on agar, the penetration of hyphae being most rapid at temperatures favouring rapid growth on agar. The rates of longitudinal penetration into the wood were closely similar to those of the radial growth on agar, while radial penetration into the wood was about one-half to one-fifth that of the growth on agar. The average temperatures within piles of timber seasoning at three sawmills were found to range from 1·3° to 6·1° below those of the surrounding air, the highest temperature recorded within any one pile being 31·5°. It is concluded that high temperatures are not an important limiting factor in the discoloration of timber during air seasoning. A moisture content of approximately 24 per cent. (oven-dry weight basis) was found to be the lower limit for staining blocks of *P. echinata* sapwood, only very

slight development of short, thick, heavy-walled filamentous hyphae being noted at moisture contents between 23 and 24 per cent. Mature brown hyphae capable of causing discoloration were relatively abundant after ten days at moisture contents above 29 per cent., infrequent at 27 to 29 per cent., and absent below 27 per cent. Serious staining is not considered likely to occur in wood below the fibre saturation point. Except for the first 24 hours, daily rates of penetration into *P. echinata* sapwood by *C. pilifera* were approximately 0·5, 1, and 4·5 mm. in the tangential, radial, and longitudinal directions, respectively. Penetration was slightly, but not significantly, less rapid in summer than in spring wood; radial penetration was two to three times greater in steamed than in unsteamed wood.

A comparison of the depths of penetration of antiseptic solutions (5 per cent. sodium bichromate, 5 per cent. sodium dinitrophenolate, 10 per cent. hydrochloric acid, 4 per cent. zinc chloride, and ethyl mercuric chloride) applied as 10-second dips, with the rates of hyphal penetration of *C. pilifera* into *P. echinata* wood, showed that under the most favourable conditions for growth the hyphae penetrated beyond the depths reached by the solutions when treatment was delayed 48 hours after inoculation. Still longer delays resulted in complete discoloration of the interiors of the test boards except for an outer zone of 1 to 4 mm. It is concluded that a period of more than one day's delay is not advisable, if control of stain in timber is to be efficient.

MELLECKER (J. B.). & BAKER (M. W.). **Expected service effectiveness of preservative treatments applied to millwork. A laboratory method of comparison.**—*Industr. Engng Chem.*, Analyt. Ed., xiv, 4, pp. 305–308, 3 figs., 1942.

A detailed, tabulated account is given of experiments to determine the relative preservative efficacy of a number of treatments applied for the control of blue stain (*Hormiscium gelatinosum*) [*R.A.M.*, xix, p. 378] to test blocks of *Pinus ponderosa* sapwood, used for window sashes, rails, and the like [ibid., xviii, p. 285], some of which were painted prior to the standard three-minute dip in the fungicidal solutions. These were evaluated by means of a scale from 0 to 3·0, on the basis of which all treatments with an average rating of 2·0 to 3·0, 1·0 to 2·0, and 0 to 1·0 were classed as low, medium, and high in resistance, respectively. None of the 'paint-inoculated' specimens showed sufficient fungal growth for evaluation by these standards: the treatments applied to the unpainted wood were ranked as follows. The low-resistance class (2·67) contained only two preparations, viz., 5 per cent. 2-chloro-ortho-phenylphenol and 95 per cent. mineral spirits (all percentages reckoned by weight); six fell into the medium group (1·5), i.e., 5 per cent. pentachlorophenol, 5 per cent. diacetone alcohol, 90 per cent. mineral spirit, 2 per cent. 2-chloro-ortho-phenylphenol, 1·5 per cent. pentachlorophenol, 1·5 per cent. tetrachlorophenol; and eight into the high-resistance category, namely, 1·5 per cent. 2-chloro-ortho-phenylphenol, 2 per cent. pentachlorophenol, 1 per cent. tetrachloro-phenol, 0·5 per cent. sym-trichlorophenol, 5·15 per cent. 2-chloro-ortho-phenylphenol, 13·75 per cent. water repellent, 2 per cent. pine oil, and 79.10 per cent. mineral spirits.

THEDEN (GERDA). **Untersuchungen über die Feuchtigkeitsansprüche der wichtigsten in Gebäuden auftretenden holzzerstörenden Pilze.** [Studies on the moisture requirements of the most important wood-destroying fungi occurring in buildings.]—*Angew. Bot.*, xxiii, pp. 189–253, 1941. [Abs. in *Chem. Zbl.*, cxiii(i), 16, p. 2083, 1942.]

Although *Coniophora cerebella* [*C. puteana*], *Poria vaporaria, Merulius lacrymans, Lenzites abietina*, and *Lentinus lepideus* [*L. squamosus*] were experimentally shown to be capable of growth on pine sapwood at a relative humidity of somewhat below 94·5 per cent. (fibre saturation point), they did not attack the wood under these conditions. *C. puteana* showed the highest degree of resistance to drought, its mycelium developing at 94·5 per cent. relative humidity. For the effective control of a fungus that has once

become established, the relative humidity must be lowered to a point below that required for the prevention of primary infection. A high water content of the wood, involving the occupation of the cavities, acted adversely on *M. lacrymans* and *C. puteana,* but was of no avail against the other fungi under observation.

KNIGHT (A. G.). **Waterproof glues.**—*Wood, Lond.*, vii, 6, pp. 109–112, 1 fig., 1942.

It is pointed out that plywood and the glue lines in it are liable to attack and destruction, under damp conditions, by various micro-organisms. A method developed by the mycologists at the Forest Products Research Laboratory, Princes Risborough, is described, which makes it possible to distinguish the harmful effects due to damp alone from those due to the attack by micro-organisms. It involves the exposure of samples to dampness under sterile conditions where the development of micro-organisms is inhibited by means of antiseptics, and under non-sterile conditions, where it is encouraged by the addition of nutrients. As a result of many tests by this method the adhesives have been classified as follows. Those unaffected by attack of micro-organisms: (1) phenolic resin glues, of the film or liquid type, whether hot- or cold-setting, and (2) all types of urea resin glues, either neat or extended with not more than 33 per cent. of flour; and adhesives that can be destroyed by micro-organisms: (1) urea resins extended with more than 50 per cent. of flour, and (2) all types of casein glues. The exact amount of flour that can be mixed with urea resins without impairing their resistance to micro-organisms remains uncertain. Attempts to improve the resistance in much extended urea resins (75 per cent. of flour and more) and in casein glues by the addition of fungicides such as beta-naphthol pentachlorphenol and its salts, and copper chloride in amounts varying from $\frac{3}{4}$ to $2\frac{1}{2}$ per cent., failed in every case to improve the durability of the glue. It is concluded that in a glue line likely to be exposed to damp, the adhesive should be a phenolic resin or a urea resin to which not more than 50 per cent. of flour has been added.

ANDERSON (H. W.), THORNBERRY (H. H.), & FULTON (J. P.). **Use of eradicant sprays for the control of Asparagus rust.**—*Phytopathology*, xxxii, 5, pp. 419–423, 1942.

Illinois asparagus-growers have become alarmed of recent years at the extension of rust (*Puccinia asparagi*) in their plantings, even among the repeatedly resistant Martha and Mary Washington varieties [*R.A.M.*, x, p. 288], and a preliminary series of tests was carried out at Urbana in 1940 to determine the value of an eradicant spray, elgetol (sodium dinitro-ortho-cresylate) [ibid., xxi, p. 383], at a strength of 0·5, 1, or 2 per cent. and a dosage of 400 or 800 gals. per acre, applied at 400 lb. pressure in the control of the disease. From the limited results as yet available, the fungicide would appear to fulfil its main object of reducing teleutospore inoculum sufficiently to preclude the formation of appreciable numbers of aecidial pustules. For instance, the numbers of stalks in 50 hills (representing some 300 stalks) bearing aecidia on 30th June following treatments with 800 gals. 1 per cent. elgetol on the previous 5th December and 27th March were 1 and 4, respectively, compared with 68 in the control plots. In another series, in which the old plants were cut off and burnt prior to spraying, the March treatments with 2, 1, 1, and 0·5 per cent. elgetol at dosages of 800, 800, 400, and 400 gals., respectively, reduced the incidence of rust to 8, 7, 8, and 2 aecidia-bearing stalks, respectively, the corresponding figures for two rows cut, burned, and sprayed in December with 2 and 1 per cent. elgetol (both 800 gals.) being 22 and 12, respectively, Since the practice of burning off the beds, besides being ineffectual in destroying all the inoculum prevents the accumulation of humus in the soil, progressive growers should make use of an eradicant spray, which obviates the need for burning, pending the development of truly resistant strains of the Washington varieties. Treatment may be confined to young beds not intended for harvesting the following spring and under these conditions the cost is not excessive.

STUBBS (L. L.). **Ascochyta blight of field and garden Peas.**—*J. Dep. Agric. Vict.* xl, 5, pp. 260–262, 3 figs., 1942.

Blight due to *Mycosphaerella pinodes* [*R.A.M.*, xxi, p. 185] is stated to be a major disease of field and garden peas in Victoria, where this fungus predominates in the causation of the disease over *Ascochyta pinodella* and *A. pisi*. In a dry season, the planting of seed infected by *M. pinodes* may not necessarily produce a badly diseased crop, but under wet conditions 100 per cent. infection may result, with heavy losses in stand and yield. Further, winter sowings are almost always attacked, though late spring sowings frequently remain healthy. The disease is thus a potential menace almost completely dependent for optimum pathogenicity upon high atmospheric and soil moisture and, possibly, upon low temperature conditions.

The use of clean seed on land not planted to peas for four or five years previously almost excludes the possibility of infection. Most commercial samples of field and garden peas sold in Victoria appear to be infected with at least one of the three blight organisms. Growers in areas where the annual rainfall reaches 25 in. or more should refrain from saving their own seed, unless they are certain that their crops are quite clean. Growers are also advised to practise a rotation that includes peas not more often than once in three years; where conditions allow, the rotation should be extended to four or five years. Sowings should be made late rather than early in areas with sufficient rain in spring and summer. Diseased crop refuse should be destroyed by burning or ploughing under the soil. Seed treatments are not recommended.

GILBERT (W. W.) & DOOLITTLE (S. P.). **Diseases and their control.** *Ex* **Cucumber growing.**—*Fmrs' Bull. U.S. Dep. Agric.* 1563, pp. 16–22, 4 figs., 1942.

In this bulletin, which supersedes No. 254 in the same series, popular notes are given on several well-known cucumber diseases and their control. Resistance to mosaic has been shown by the Shamrock variety, originating at the Iowa Agricultural Experiment Station.

STIER (H. L.). **Are some of our Cantaloupe troubles caused by nutrient deficiences rather than by diseases?**—*Trans. Peninsula hort. Soc.*, xxxi, 4, pp. 88–90, 1942.

A brief description is given of nutrient deficiency symptoms observed in cantaloupe plants grown in pots and supplied with nutrient solutions lacking in one of the following: nitrogen, phosphorus, potassium, calcium, magnesium, boron, manganese, sulphur, and iron.

STODDARD (D. L.). **Fusarium wilt of Cantaloupe and studies on the relation of potassium and nitrogen supply to susceptibility.**—*Trans. Peninsula hort. Soc.*, xxxi, 4, pp. 91–93, 1942.

Wilt due to *Fusarium bulbigenum* var. *niveum* f. 2 [*R.A.M.*, xviii, p. 368] is stated to constitute a serious menace to the cantaloupe industry in Maryland. It was found for the first time in the State about five years ago, and at present threatens the extinction of much of the area planted to cantaloupes in Anne Arundel County, where last summer the losses in some fields amounted to 100 per cent. On the Eastern Shore the situation is less serious. Losses range from 20 to 50 per cent. in several fields near Preston.

Preliminary studies indicated that the fungus grows best when supplied with nitrogen as nitrate, and that the incidence of the disease is reduced by high potash-containing fertilizers and lime. To ascertain the effect of maintaining a high potassium level, an experiment was carried out with five levels of nitrate (100, 275, 447, 620, and 744 p.p.m.) and four of potassium (78, 117, 156, and 195 p.p.m.). Magnesium, calcium, and phosphate were held constant at 48, 160, and 190 p.p.m., respectively. The plants were grown in white sand in crocks and were inoculated with a suspension

of the fungus by pouring inoculum into holes drilled in the sand to such a depth as to ensure bruising the roots. The results showed conclusively that there is a ratio of potassium to nitrate at which infection can be reduced. For example, deaths from wilt after 20 days were only 1 with 195 p.p.m. potassium and 100 p.p.m. nitrate, 2 when the corresponding figures were 195 and 275 or 447, but 7 when they were 195 and 620 or 744, and 8 when they were 78 and 620. Further tests are to be made. One grower used a 5–8–12 instead of a 6–6–5 fertilizer on badly infected land, and was able to harvest the crown set of melons before the plants were severely affected.

HUMPHREY (N.). **A note on Groundnut selection work.**—*E. Afr. agric. J.*, vii, 4, pp. 220–221, 1942.

By means of continuous selection at the Coast Experiment Station, Kibarani, Kenya, it has been possible to maintain the resistance of groundnuts to *Fusarium* wilt [*R.A.M.*, xix, p. 62] at a sufficiently high level for economic cultivation by the natives, who have already obtained yields of over 1,000 lb. unshelled nuts per acre. The percentages of infection in progeny rows for the years 1937, 1938, 1939, and 1940 were 25·5, 9·5, 6·1, and 9·7, respectively.

ZILLIG (H.) & NIEMEYER (L.). **Wie spart man Kupfer bei der Plasmoparabekämpfung?** [How can copper consumption in *Plasmopara* control be reduced?]—*Wein u. Rebe*, xxiv, 2, pp. 25–47, 1942. [Abs. in *Chem. Zbl.*, cxiii (i), 23, pp. 2921–2922, 1942.]

Particulars are given of experiments at the viticultural branch of the Biological Institute, Bernkastel-Kues on the Moselle, to determine the possibility of economizing in copper consumption in the control of downy mildew (*Plasmopara viticola*) [*R.A.M.*, xxi, p. 402], in which connexion it is stated that the normal German requirement of copper sulphate for this purpose amounts to 24,000 tons for the treatment of an area of 150,000 ha. with a 1 per cent. solution. The replacement of copper by more readily available metals was found to be impracticable. Among the non-metallic preparations tested, PF 89 (Schering A. G.) proved equally effective with Bordeaux mixture, but at some seven times the cost of the latter. Good results were also obtained with preparation 122 (same firm), which was further useful as an insecticide. Five years' trials demonstrated the feasibility and safety of a reduction of the standard copper concentration of between 1 and 1·5 to between 0·5 and 1 per cent. Copper oxychloride solutions, which exert practically no deleterious effect on the growth of the host, are of some value as pre-blossom sprays [ibid., xxi, p. 279], but cannot be substituted for copper sulphate in the rest of the schedule, since even at a strength of 1 per cent. and a copper of 15 to 18 per cent. they are not equivalent to 0·5 per cent. Bordeaux mixture with a 12·5 per cent. copper content.

DENNIS (R. W. G.) & FOISTER (C. E.). **List of diseases of economic plants recorded in Scotland.**—*Trans. Brit. mycol. Soc.*, xxv, 3, pp. 266–306, 1 map, 1942.

This list of diseases of economic plants in Scotland incorporates additional records that have accumulated since the publication of Alcock and Foister's list in 1931 [*R.A.M.*, xi, p. 222]. The known geographical distribution of the diseases is indicated in relation to the main drainage areas, which are shown on a map, and those diseases whose presence in Scotland has been verified by either of the authors are marked with an asterisk.

In an introductory statement, readers are informed that Scotland remains relatively free from a number of destructive diseases prevalent in England. Thus, to quote a few examples, *Rosellinia necatrix* has not been reported, *Helicobasidium purpureum* is very rare, and rots due to *Sclerotinia sclerotiorum* are far from common. On cereals, *Puccinia triticina*, *Ophiobolus graminis*, *Septoria tritici*, *Dilophospora alopecuri*, and *Rhynchosporium secalis* are either unknown or very rare. Asparagus rust (*P. asparagi*)

appears to have been extinct since discovered by Greville at Edinburgh in 1824. Elm disease (*Ceratostomella ulmi*) has failed to establish itself. On the other hand, antirrhinum rust (*P. antirrhini*), first recorded in England in 1933, was found in 1935, and has since been observed in numerous localities.

KAMAT (M. N.). **Progress of plant pathological research in Bombay.**—*Poona agric. Coll. Mag.*, xxxiii, 3, pp. 97–100, 1941.

Reference has already been made in this *Review* to most of the phytopathological problems on which the staff of the plant pathology section of the Bombay Department of Agriculture has been engaged for the last 15 years, but attention may be directed to the following item in this brief survey of the work accomplished. Recent experiments in connexion with the development of resistance to banana wilt [*Fusarium oxysporum* var. *cubense*] showed the highly resistant and commercially superior Basrai variety to be eminently suitable as a substitute for the susceptible Son in the Poona district [*R.A.M.*, xix, p. 641].

**Plant diseases. Notes contributed by the Biological Branch.**—*Agric. Gaz. N.S.W.*, liii, 5, pp. 239–242, 4 figs., 1942.

Detailed directions are given for the preparation of Bordeaux mixture.

Lettuce drop (*Sclerotinia* [*sclerotiorum*]) causes heavy losses during the cool part of the year in coastal parts of New South Wales. If the disease appears for the first time in any district, and not many plants are affected, an attempt may be made to eradicate it immediately, by removing and burning all diseased plants, with the sclerotia attached to them. The fungus also causes much damage in some years to citrus trees [*R.A.M.*, xv, p. 213] and passion vines [*Passiflora edulis*]. On the former, it causes blighting of twigs or even of large limbs in late winter or early spring; it may also produce a gumming of the collar-rot type at the base of the trunk, and in some years is responsible for a severe nursery blight. Affected parts should be removed and burned during pruning. On passion vines the fungus causes shoot blight and collar rot. In these cases also, the affected parts should be removed and burned.

Citrus growers whose trees have been treated against *Armillaria* [*mellea*] should regularly inspect the excavations round the crown roots to make sure that they have not become filled up, through washing in of soil and rubbish. On no account should weeds be allowed to grow round the butts of treated trees.

**Fifty-second and fifty-third Annual Reports of the Tennessee Agricultural Experiment Station, 1939 and 1940.**—79 pp., 8 figs., 2 maps, 1940; 109 pp., 29 figs., 4 graphs, 1 map, 1941. [Received July, 1942.]

Among the items of phytopathological interest in various sections of these reports may be mentioned the following. In further regional studies by C. D. Sherbakoff in co-operation with the United States Department of Agriculture on cotton wilt (*Fusarium*) [*vasinfectum*], the Dixie Triumph 12 and Clevewilt 6 varieties showed complete resistance to the disease over a three-year period, whereas Miller 610 and Rowden 2088 were dependable in this respect only where infection was mild and a balanced fertilizer, including sufficient potash, had been applied; Coker 100 and Half and Half sustained severe injury even from slight attacks of the fungus [*R.A.M.*, xxi, pp. 74, 197].

Very promising results in regard to resistance to wilt [*F. bulbigenum* var. *niveum*] were obtained in tests on severely infested soil with the Hawkesbury watermelon [ibid., xvii, p. 298; xviii, p. 368].

None of the 180 tomato selections tested in 1940 for resistance to leaf spot or blight (*Alternaria solani*) was found to possess true resistance.

Eradicant sprays, consisting of Bordeaux mixture plus calcium and zinc arsenates, and in one case elgetol [ibid., xxi, p. 383], were no more effective in experiments car-

ried out by R. A. Hyre and J. O Andes against bitter rot [*Glomerella cingulata*] of apples than the standard Bordeaux mixture at normal or half strength. Eradicant treatment was successful in the control of blotch [*Phyllosticta solitaria*], but not to the same extent as the summer sprays of Tennessee '34' copper. Yellow cuprocide (1½ lb. per 100 gals.) caused severe injury to Golden Delicious apples, while the damage inflicted by two neutral Bordeaux mixtures was only slightly less than that due to the standard 8–12–100 formula on this variety.

Seedling pear selections from crosses containing a quarter of *Pyrus serotina* were found by B. D. Drain, A. B. Strand, and D. M. Bailey to combine a high degree of resistance to fire blight [*Erwinia amylovora*] with suitable commercial characteristics.

**Fifty-eighth Annual Report for year ended June 30, 1941, Agricultural Experiment Station, Wisconsin. Part II** (*Bull.* 455).—87 pp., 29 figs., 2 graphs, 1942.

This report [cf. *R.A.M.*, xx, p. 518] contains the following items of interest. Seed of the Vicland oat variety, resistant to stem rust [*Puccinia graminis*], leaf rust [*P. coronata*], and smuts [*Ustilago avenae* and *U. kolleri*], was placed on the market in Wisconsin for the first time in 1942. This variety is regarded as superior to Vanguard [ibid., xix, p. 83], which is susceptible to leaf rust and smut, and while on an average Vanguard during the past five years has yielded only 2 per cent. more than State's Pride, Vicland has yielded 34 per cent. more. It is, however, the shortest-strawed of all Wisconsin oat varieties, and is handicapped on poor, sandy soil. It gives less trouble from lodging than any other variety grown in the State, and is suitable for highly fertile or moist soils where most varieties would be practically certain to go down.

'Deep' or 'pitted' scab of potatoes, which appears to be a combination of ordinary scab [*Actinomyces scabies*] and infestation by the scab gnat [*Pnyxia scabiei*: cf. ibid., xxi, p. 266], is becoming more troublesome. The maggot form of the insect attacks potatoes at points where the skin has been broken by scab, and feeds on the tissue in the scab spot until moderately deep wounds are produced. The maggots attack both seed pieces and growing tubers, and may continue to feed on stored potatoes. No entirely satisfactory method of control is at present known, apart from the use of scab-resistant varieties.

Sebago and Pontiac are now added to those potato varieties (chiefly Chippewa and Triumph) which do not tend to turn black when cooked [ibid., xxi, p. 41]. Apparently the tendency to 'cook white' is an inherited trait. On the basis of a 'blackening index', in which 0 = perfectly white and 100 = dark grey, varieties tested over five years rank as follows: Triumph 20, Chippewa 21, Houma 27, Katahdin 29, Red Warba 30, Irish Cobbler 37, Green Mountain 38, Rural New Yorker 45, and Russet Rural 49.

Triumph and Cobbler potatoes growing on burned peat soil showed a condition in which the new leaves were yellowish and later showed pin-point spots and stunting. Some of the plants wilted and died, while others grew slowly and produced small tubers. The application of 12 lb. manganese sulphate per acre in a 1 per cent. spray at four 10-day intervals kept the potatoes green until August [cf. ibid., xxi, p. 92]. Manganese deficiency was clearly involved but apparently there was a deficiency of zinc and possibly of copper also in the part where the peat had burned most thoroughly some years before, because here the use of zinc sulphate and copper sulphate with manganese enabled the potato vines to remain green for two weeks longer than those sprayed with manganese sulphate alone.

Symptoms of potato bacterial ring rot [*Corynebacterium sepedonicum*: ibid., xxi, p. 263], which is stated to be spreading locally, do not always show up in the field in Wisconsin, though they commonly do so farther south. A crop without conspicuous damage at digging may decay badly in storage. When foliage injury does develop in Wisconsin, it generally appears after blossoming. Some of the younger leaflets lose their firmness, begin to wilt, and roll slightly inwards and upwards towards the

midrib. A slight mottling may appear as the leaflets turn pale green to yellow. Finally, the rolled leaf edges dry out and shrivel. The entire plant may droop and wilt from the top downwards. The only method of control is to plant clean seed.

Indirect evidence indicates that the Sebago potato variety is resistant to yellow dwarf [ibid., xxi, p. 264].

Squash [*Cucurbita* sp.] wilt [*Fusarium bulbigenum* var. *niveum*] has in recent years caused damage in the south-eastern, central, and west-central areas of Wisconsin, the losses in some cases reaching 90 per cent. of the crop. At present, the only method of control is to plant the resistant Fable Queen variety. Watermelon varieties showing a valuable degree of resistance to the fungus in Wisconsin are Leesburg, Klondike No. 7, Hawkesbury, Improved Kleckley No. 6, and Stone Mountain No. 5.

Garden and sugar beets growing on boron-deficient soil derived marked benefit from borax sprays and dusts applied at midsummer [ibid., xxi, p. 114]. Preliminary tests indicated that summer applications alone, if made before the deficiency symptoms become apparent, may prove to be sufficient to control the disorder. Borax spraying or dusting is recommended in those fields where a soil application at seeding is insufficient. In a test field to which 50 lb. of borax per acre was applied at seeding, beets showing black spot in mid-July were sprayed on 22nd July, before root symptoms appeared, at a rate equivalent to 50 lb. of borax per acre. On 12th August, only 4 per cent. of the sprayed beets were affected, as against 32 per cent. of the unsprayed. Midsummer applications of borax dusts to sugar beets at the rate of 40 lb. per acre completely eliminated heart rot and greatly increased yield.

Investigations on cabbage club root [*Plasmodiophora brassicae*] showed that mustard oil in high enough concentrations prevented germination of the fungus [ibid., xviii, p. 508], while low concentrations stimulated it. Thus, if the oil is liberated from plant roots, it may predispose the plants to infection by hastening the germination of spores in the soil, or possibly by stimulating the growth of the organisms after they penetrate the roots. One type of mustard oil, allyl isothiocyanate, in seven experiments stimulated spore germination when used at concentrations between 1·25 and 50 parts per million; in most cases 40 to 80 p.p.m. were necessary to prevent germination, though in one case 10 p.p.m. sufficed. The other mustard oil, beta phenyl ethyl isothiocyanate was in general more toxic than the allyl type.

Of various fertilizer treatments applied on 28th August to unthrifty celery which had received a side dressing of 500 lbs. of 3–9–18 fertilizer per acre shortly after planting in July, the best was 500 lb. 3–12–12 plus 25 lb. copper sulphate, which increased yields 87 per cent. over the control and 80 per cent. over the part given 3–12–12 without copper. The use of 50 lbs. of borax with the 500 lb. 3–12–12 increased yields by 80 per cent. over the control and 53 per cent. over the plot given 3–12–12 alone. The borax-treated celery was also free from cracked stems [ibid., xx, p. 192], which were noted elsewhere in the field.

Confirmatory evidence has been obtained that yellows of sour cherry in Wisconsin [ibid., xix, p. 30; xx, p. 373] is caused by a virus. The disease can also attack choke-cherry [*Prunus virginiana*] and the Mahaleb cherry, but sweet cherries are not affected. In Door county, the number of affected trees increases by about 3 per cent. each year, to judge from five years' observations on 2,500 trees in five orchards. Nearly 11 per cent. diseased trees were found last year of 6,500 examined in 18 orchards. Yield reduction is severe on trees that have shown symptoms for four or five years. Only disease-free stock should be planted, and all young trees that become affected should be destroyed.

Several years' tests showed that cherry leaf spot [*Coccomyces hiemalis*: ibid., xxi, p. 245] is as well controlled by four applications of Bordeaux mixture 3–4–100 as by three at 6–8–100 concentration. Last year's trials on Montmorency trees showed that Bordeaux mixture (6–8–100) made with high-calcium lime and applied in the three-spray programme (at petal-fall, about two weeks later, and just after harvest) gave

excellent control, but injured the foliage late in the season; it also reduced the size of the fruit by 15 per cent. Bordeaux mixture (3–4–100) in a four-spray programme (i.e., as above, but with a further application about four weeks after petal-fall) gave approximately the same results as three applications at 6–8–100, though in some years the lower concentration reduced the fruit size less than the standard treatment. Four applications of Bordeaux mixture ($1\frac{1}{2}$–2–100) gave satisfactory control on some occasions, with little fruit injury or reduction in size, but this programme was not always effective. The use of high-magnesium instead of high-calcium lime in the various Bordeaux treatments reduced foliage injury without affecting degree of control or fruit size. Basicop plus high-magnesium lime (3–8–100) gave fairly satisfactory control without foliage injury, but reduced fruit size. Cupro-K and high-magnesium lime (3–3–100) plus 1–800 oil failed to give good control. Tennessee copper 34 and high magnesium lime (3–3–100) plus 1–800 orthex controlled leaf spot without foliage injury and gave fruit larger by 10 per cent. than the effective Bordeaux treatments.

Inoculating evergreen seedlings with suitable mycorrhizal fungi, particularly *Boletus felleus*, greatly improved their growth and survival on prairie soil. The evidence obtained indicated that the mycorrhizal fungi rendered the potassium present in the soil more readily available to the seedlings.

**Principales enfermedades parasitarias [y] no parasitarias que fueron objeto de consulta en el primer semestre (Enero–Junio) de 1941.** [The principal parasitic and non-parasitic diseases which were the object of consultation during the first six months (January to June) of 1941.]—*Bol. Sanid. veg., Santiago*, i, 1, pp. 79–83, 1941.

Among the diseases engaging the attention of the phytopathological staff of the Chilean Ministry of Agriculture during the period from January to June, 1941, may be mentioned raspberry anthracnose (*Elsinoe veneta*), *Plectodiscella* [*E.*] *piri* and *Nectria galligena* on apple [*R.A.M.*, xix, p. 366], *Colletotrichum gloeosporioides*, witches' broom, and *Phytophthora citrophthora* on orange, *Coryneum beijerinckii* [*Clasterosporium carpophilum*: ibid., xx, p. 9] on apricot, *Guignardia bidwellii* on vine, *Colletotrichum lindemuthianum* and *Fusarium martii* on French bean (*Phaseolus vulgaris*), *Uromyces fabae* on broad bean, and blossom-end rot of tomato.

Katznelson (H.). **Inhibition of micro-organisms by a toxic substance produced by an aerobic spore-forming bacillus.**—*Canad. J. Res.*, Sect. C, xx, 3, pp. 169–173, 1942.

The bacillus recently shown by Cordon and Haenseler to produce a thermostable toxin active against *Rhizoctonia* [*Corticium*] *solani* [and regarded by them as a rough strain of *Bacillus simplex*: *R.A.M.*, xviii, p. 567] was found by the author to produce a thermostable diffusible substance which inhibited the growth of 77 out of 81 species of fungi. Actinomycetes were more tolerant to it than fungi, though some were completely inhibited. The majority of streptococci, staphylococci, bacilli, lactobacilli, and clostridia tested were suppressed by the toxic medium, but Gram-negative organisms were unaffected. *B. subtilis* and, to some extent, *B. cereus* and *B. pumilus* also produced thermostable substances toxic to *C. solani*.

The toxic substance produced by Cordon and Haenseler's organism was completely adsorbed by soil, bentonite, and activated charcoal, partly by agar, and not at all by talc; it passed through cellophane, parchment, and collodion, resisted autoclaving for 30 to 45 minutes at 15 lb. pressure, but was rapidly destroyed by heating in alkaline (less rapidly in acid) solutions. It was not inactivated by aeration and retained its potency for many months at 0° C. It was not removed from the toxic medium by ether, chloroform, benzene, ethyl acetate, or N butyl alcohol, but was partially eluted from charcoal with 95 per cent. ethyl alcohol.

STAPP (C.). **Der Pflanzenkrebs und sein Erreger Pseudomonas tumefaciens. IX. Mitteilung. Daphne mezereum L. als weitere neue Wirtspflanze.** [Crown gall of plants and its agent *Pseudomonas tumefaciens*. Note IX. *Daphne mezereum L.* as a further new host plant.]—*Zbl. Bakt.*, Abt. 2, cii, 15–17, pp. 295–300, 1 fig., 1940.

From tumours on naturally infected young *Daphne mezereum* plants from a plant protection station in north-west Germany the writer isolated a strain of *Pseudomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xix, p. 201], which proved to be highly pathogenic to *Pelargonium zonale* and slightly so to *Datura tatula*, while sunflowers and tomatoes reacted negatively to inoculation. The new strain was found to be serologically distinct from the several forms of *Bact. tumefaciens* harboured by *Dahlia variabilis*, *Asparagus sprengeri*, and beans (*Phaseolus vulgaris*), though agreeing with them in morphological and cultural characters, including 'star' formation [ibid., xi, p. 357] in an iron-manganese-carrot juice medium.

STAPP (C.). **Der Pflanzenkrebs und sein Erreger Pseudomonas tumefaciens. XI. Mitteilung. Zytologische Untersuchungen des bakteriellen Erregers.** [Crown gall of plants and its agent *Pseudomonas tumefaciens*. Note XI. Cytological studies of the bacterial agent.]—*Zbl. Bakt.*, Abt. 2, cv, 1–4, pp. 1–14, 3 pl., 1942.

The results of comparative cytological studies on a number of spore-forming bacteria and *Pseudomonas* [*Bacterium*] *tumefaciens* (strains Ra from dahlia and IIb from *Chrysanthemum frutescens*) showed that individual members of the so-called 'star' or 'rosette' phase in the development of the crown gall pathogen [see preceding abstract] are mostly uni- or bi-, seldom tri- or quadrinucleate. When the rods have fused into a complex, the individuals begin to elongate and thicken, and if a preparation is stained at the critical phase the individual rods of the star complex are found uniformly to contain only one nucleus, at or near the polar end connected with the centre. At a somewhat later stage there are no more individual nuclei but one large central nucleus resulting from the fusion of the individuals participating in the formation of the star. On the dissolution of this central nucleus each individual rod once more acquires a nucleus, the subsequent division of which is followed by subdivision into short swarming rods.

KELLY (C. F.), STAHL (B. M.), SALMON (S. C.), & BLACK (R. H.). **Wheat storage in experimental farm-type bins.**—*Circ. U. S. Dep. Agric.* 637, 245 pp., 7 figs., 7 diags., 18 graphs, 1 map, 1942.

One of the objects of this comprehensive series of experiments on wheat storage on farms, carried out from 1936 to 1941 in four different States, Maryland, Illinois, Kansas, and North Dakota, was to ascertain the value of fungicidal treatment of the seed-grain before placing it in the bins. A mixture of lime and sulphur (3 or 4 : 5 or 6 parts by weight), at various dosages, e.g., 0·1 lb. per bush., proved to be of some use in postponing the development of abnormal odours, but caused a decrease in weight which in several cases was sufficient to lower the numerical grade of the product. A formalin-water solution (1:1), used at the rate of ½ pint per 22 bush. seed-grain, failed to prolong the safe storage period but caused no reduction in weight. The treatment adversely affected the baking qualities of soft red winter wheat, while those of hard red spring were not impaired.

BAYLIS (G. T. S.). **Viability of dusted Wheat after storage.**—*N. Z. J. Sci. Tech.*, A, xxiii, 3, pp. 126–130, 1941.

Both agrosan G and ceresan U.T. 1875 A improved the field germination at Lincoln, Canterbury, New Zealand, of Solid Straw Tuscan wheat seed-grain stored under normal conditions at Christchurch for 12 months between the dates of dusting and sowing, both preparations being applied at dosages of 2 and 4 oz. per bush. The moisture contents of the seed samples ranged from 12·8 to 16·7 per cent., and at the

higher proportion injury was sustained by those stored for a year in a closely sealed tin. The average laboratory germination of untreated and ceresan-dusted seed after 14 months was 79 and 83 per cent., respectively, compared with 92 per cent. for treated material stored in sacks. The average field germination after one year's storage in sacks of untreated seed-grain with moisture contents of 16·7, 15·9, 15·4, 15, 14·1, 13·2, and 12·8 per cent., respectively, amounted to 67, 75·5, 69, 74, 80, 81·5, and 82·5 per cent., respectively, the corresponding figures for the dusted samples (average of all treatments) being 70·6, 76·8, 81·3, 86, 86, 85·8, and 88·1 per cent., respectively.

STUMBO (C. R.), GAINEY (P. L.), & CLARK (F. E.). **Microbiological and nutritional factors in the take-all disease of Wheat.**—*J. agric. Res.*, lxiv, 11, pp. 653–665, 4 figs., 1942.

In the course of studies on the take-all (*Ophiobolus graminis*) disease of wheat [*R.A.M.*, xxi, p. 133] it was found that no differences exist in either the number or kind of micro-organisms in infested and non-infested field areas of the silt loam and clay loam prairie soils tested. There appeared to be no correlation between the level of available phosphorus and the incidence of disease. In pot experiments in the greenhouse, using Kanred wheat, the addition at planting time of ground wheat straw to naturally infested soil resulted in a significant increase of soil micro-population for several months, and even the heaviest doses of inorganic fertilizers failed to maintain the available phosphorus and nitrate nitrogen content at a satisfactory level throughout the growing season; all plants proved to be badly diseased at maturity. The application at sowing time of adequate supplies of either available phosphorus (as superphosphate) or nitrate nitrogen (slightly in excess of the amount calculated as necessary for plant growth) alone appeared to effect no appreciable reduction in the severity of the disease, but when both were applied, the severity was reduced by increasing rates of superphosphate. Successful control of *O. graminis* was obtained in pots (with three plants in each) receiving 200 p.p.m. of phosphorus as superphosphate at planting time and 224 mg. nitrogen per plant added as ammonium nitrate in 60 applications of 4 p.p.m. nitrogen each during the growing season. These results indicate that nutritional factors are extremely important in determining the severity of take-all disease.

FULLING (E. H.). **Plant life and the law of man. III. Barberry eradication.**—*J. N.Y. bot. Gdn*, xliii, 510, pp. 152–157, 1942.

This is an outline of the gradual recognition of the part played by the barberry in the dissemination of wheat rust [*Puccinia graminis*], and of the legislative measures adopted to eliminate this carrier of infection in various European countries [*R.A.M.*, ii, p. 499] and the United States [ibid., xviii, p. 165; xix, p. 395, *et passim*], where Connecticut was the pioneer among the States in this direction, its first eradication law having been passed in 1726. Towards the end of the colonial period, however, the initial American attempts to combat the wheat rust by the extirpation of its alternate host were gradually abandoned, only to be resumed on a firmer basis of scientific knowledge during and after the first quarter of the twentieth century.

SUNESON (C. A.) & HOUSTON (B. R.). **Male-sterile Barley for study of floral infection.**—*Phytopathology*, xxxii, 5, pp. 431–432, 1942.

Male-sterile barley, which it has been suggested may be of service to plant breeders (*J. Hered.*, xxxi, pp. 213–214, 1940), appears likely to provide a means of mass inoculation of barley flowers with cultures of disease-producing fungi transmitted by floral infection. At Davis, California, male-sterile barley spikes were inoculated with spores of *Helminthosporium gramineum* and *Ustilago nuda*, the former fairly prevalent and the latter seldom persistent under local conditions. In the stripe disease tests,

the spikes were first pollinated by mass dusting with pollen from $F_1$ hybrids heterozygous for the male-sterile factor. Leaves from plants killed by the fungus were next pulled from the top of the spike downwards between each row of glumes to facilitate discharge of the spores into the open florets, and the inoculated spikes were then bagged. The percentage of infection ranged from 70 to 89·5 per cent., which is approximately equal to that obtained by the culture of sprouting barley on a substratum supporting mycelial growth of *H. gramineum*. In the case of *U. nuda*, mass dusting with both pollen and smut spores was requisite, but only a low incidence of infection (0 to 31·6 per cent.) was obtained, possibly due to varietal resistance, low atmospheric humidity at the time of inoculation, or poor viability of the spores [*R.A.M.*, xx, p. 296].

Reed (G. M.). **Reports on research for 1941. Plant pathology.**—*Rep. Brooklyn bot. Gdn, 1941* (*Brooklyn bot. Gdn Rec.*, xxxi, 2), pp. 90–94, 1942.

The outstanding feature of the 1941 investigations on oats smuts [cf. *R.A.M.*, xx, p. 392] was the detection of a new specialized race of loose smut [*Ustilago avenae*] pathogenic to Victoria and many of the hybrid selections of which it is one of the parents [ibid., xxi, p. 251].

The results of further studies conducted on three hybrids with the Navarro variety of oats, noted for its high degree of resistance to *U. avenae* and covered smut [*U. kolleri*], as one of the parents have already been noted from another source [ibid., xxi, p. 367].

In a series of experiments by Jeanne P. Walther to determine the effects of inoculation with *U. avenae* and *U. kolleri* on resistant and susceptible oats varieties, the treated seedlings generally showed a reduced rate of emergence as compared with the uninoculated. Varieties inoculated with races of *U. kolleri* to which they were susceptible were not appreciably delayed in their development, whereas a marked retardation followed the treatment of the same varieties with less pathogenic races. Similar responses were observed among the varieties to inoculation with *U. avenae*. Some varieties susceptible to both smuts made abnormally slow growth after inoculation but appeared to be stimulated to some extent by infection with races to which they were resistant.

In further studies by L. G. Utter on the effects on Gothland, Monarch, and six other oats varieties of 40 collections of smut originating from the hybridization of race 1 of *U. avenae* and race 1 of *U. kolleri*, 24 resembled the latter in symptomatology and morphology and 16 the former. Combining the infection data of 1941 with those obtained from 1938 to 1940, it was possible to separate 13 races of *U. kolleri* on the eight test varieties, most of which were resistant to race 1, while displaying variable reactions to the new races. Similar results were secured with nine races of *U. avenae* on six varieties, all of which, except Monarch, were susceptible to race 1 while differing in their responses to the other races used in the tests.

Hagborg (W. A. F.). **Classification revision in Xanthomonas translucens.**—*Canad. J. Res.*, Sect. C, xx, 5, pp. 312–326, 1942.

Referring to the long-apparent need for a revision of the classification of *Phytomonas translucens*, the author points out that in 1917, Jones, Johnson, and Reddy described the species as *Bacterium translucens*, the organism causing bacterial blight of barley. Two years later, Smith, Jones, and Reddy described a variety, *Bact. translucens* var. *undulosum*, which resembled the original species, but attacked wheat, barley, and rye. In 1924, Reddy, Godkin, and Johnson described a second variety, *Bact. translucens* var. *secalis*, attacking rye only [*R.A.M.*, iv, p. 160]. In 1936, Hagborg transferred *Bact. translucens* var. *undulosum* to *Phytomonas* and changed its rank to forma specialis [ibid., xvi, p. 91]. In 1939, Dowson transferred the original species to *Xanthomonas* as *X. translucens* [ibid., xviii, p. 658]. In the present paper the author reports the discovery of two further forms of the same species showing specialized

parasitism. He accepts the genus *Xanthomonas*, but emends the description of *X. translucens* to include all the derivatives, which are described as five formae speciales of the emended species.

The emended determinative description of *X. translucens* is as follows: straight rods, not producing endospores, motile by a single polar flagellum; growth on peptone beef agar yellow after four days; gelatine liquefied, nitrites not produced from nitrates, pathogenic on one or more genera of Gramineae; known to consist of several formae speciales.

The two new formae speciales, unlike any of the forms reported hitherto, are both capable of causing water-soaked lesions on oats seedlings after artificial inoculation, which may be made with or without wounding. They are straight, yellow rods, motile by means of a single polar flagellum; they do not produce endospores, they liquefy gelatine, and they are unable to reduce nitrates to nitrites. One of them can infect barley and oats but not wheat and rye, and is named *X. translucens* f. sp. *hordei-avenae*; the other infects wheat, oats, barley, and rye, and is named *X. translucens* f. sp. *cerealis*.

The determinative descriptions of the five known special forms are as follows. (1) *X. translucens* f. sp. *hordei* f. sp. nov. (synonyms: *Bact. translucens* Jones, Johnson, & Reddy, 1917, *sensu stricto*, *Pseudomonas translucens* Stapp, 1928, *Phytomonas translucens* Bergey *et al.*, 1930 and *X. translucens* Dowson, 1939) occurs naturally on *Hordeum* spp.; produces water-soaked infections following wound inoculation at 25° to 30° C. in seedlings of *Hordeum* spp. but not of *Triticum* spp., *Avenae* spp., or *Secale cereale*. (2) *X. translucens* f. sp. *undulosa* (S., J., & R.) comb. nov. (synonyms: *Bact. translucens* var. *undulosum* Smith, Jones, & Reddy, 1919, *Pseudomonas translucens* var. *undulosa* Stapp, 1928, and *Phytomonas translucens* f. sp. *undulosa* Hagborg, 1936) occurs naturally on *Triticum* spp. and on *Secale cereale*; produces water-soaked infections following wound inoculation at 25° to 30° in seedlings of *Triticum* spp., *Hordeum* spp., and *S. cereale*, but not of *Avena* spp. (3) *X. translucens* f. sp. *secalis* (R., G., & J.) comb. nov. (synonyms: *Bact. translucens* var. *secalis* Reddy, Godkin, & Johnson, 1924, *Pseudomonas translucens* var. *secalis* Stapp, 1928, and *Phytomonas translucens* var. *secalis* Bergey *et al.*, 1939) occurs naturally on *S. cereale*; produces water-soaked infections following wound inoculation at 25° to 30° in seedlings of *S. cereale*, but not of *Triticum* spp., *Hordeum* spp., or *Avena* spp. (4) *X. translucens* f. sp. *hordei-avenae* f. sp. nov. occurs naturally on *Hordeum* spp.; produces water-soaked infections following wound inoculation at 25° to 30° in seedlings of *Hordeum* spp., and *Avena* spp., but not of *Triticum* spp. or of *S. cereale*. (5) *X. translucens* f. sp. *cerealis* f. sp. nov. occurs naturally on *Triticum* spp.; produces water-soaked infections following wound inoculation at 25° to 30° in seedlings of *Triticum* spp., *Hordeum* spp., *Avena* spp., and *S. cereale*.

The non-determinative cultural characters of 13 pure cultures of *X. translucens* emend. of monocolonial origin, which had been isolated from various cereals and found to be pathogenic on one or more of them, were studied in detail. The 13 test cultures belonged to *X. translucens* f. sp. *undulosa*, *X. translucens* f. sp. *hordei-avenae*, and *X. translucens* f. sp. *cerealis*; for comparative purposes, check cultures of *Pseudomonas atrofaciens*, *P. coronafaciens*, and *P. medicaginis* var. *phaseolicola* were included in the studies. The results were as follows. All the test but none of the check cultures produced hydrogen sulphide. All cultures, both test and check, produced ammonia in peptone beef broth. No test culture produced a water-soluble, green, fluorescent pigment. Litmus milk was decomposed by the test cultures only. In general, the test cultures were able to digest dextrose, *d*-levulose, *d*-mannose, *d*-galactose, sucrose, lactose, and salicin, but not *l*-rhamnose, inosite, maltose, raffinose, inulin, starch, mannitol, and dulcitol. *X. translucens* was found to be capable of digesting starch, but only in the presence of a basal medium that in itself permits good growth; the organism is weak in diastatic enzymes. No correlation was found between any cultural character in the different forms of *X. translucens* and pathogenicity. Differences in pathogenic

capabilities occurred between different isolates of the same forma specialis, suggesting that it may become necessary to recognize different races within the special forms.

Stringfield (G. H.) & Bowman (D. H.). **Breeding Corn hybrids for smut resistance.** —*J. Amer. Soc. Agron.*, xxxiv, 5, pp. 486–494, 3 graphs, 1942.

Smut (*Ustilago zeae*) counts made in 48 maize performance experiments in 13 counties of Ohio from 1933 to 1938 indicated that some three-quarters of the hybrid entries carried less infection than the open-pollinated varieties [cf. *R.A.M.*, x, p. 723], Woodburn, Cook, Medina Pride, Waugh, and Clarage. Twelve inbred lines appeared to be more or less resistant to the disease, viz., Ohio 02, 10, 15–6, 26, 51, 56, 66, 84, 306 A, and 601 S, C. I. 4–8, and Iowa L 317, and hybrids in which half or more of the parentage consisted of these strains showed less than a third as much smut as the open-pollinated varieties. Some of these hybrids combine resistance to smut with other desirable commercial qualities, and their extensive cultivation and that of similar lines in other States constitutes the first significant advance in the control of the disease.

Richardson (J. K.). **Studies on root rot of Corn in Ontario.**—*Canad. J. Res.*, Sect. C, xx, 4, pp. 241–256, 1 pl., 15 figs., 1942.

In laboratory and greenhouse studies of maize root rot [*R.A.M.*, xx, p. 344] in Ontario, isolations from small roots of maize plants grown in unsterilized, root-rot-infested soil and greenhouse compost yielded a number of organisms, of which the following six were proved by inoculation to be parasitic: a *Pythium* sp. believed to be *P. arrhenomanes*, *P. de Baryanum*, *Helminthosporium bicolor*, *H. maydis*, and two species of *Fusarium*. *P. arrhenomanes* and both *H.* spp. caused a reduction in the germination of maize seed of 40 to 50 and 5 to 10 per cent., respectively; and maize plants grown in sterilized soil, to which these fungi were added, remained 5 to 8 in. high after 24 days of growth whereas those grown in soil inoculated with *P. de Baryanum* and *F.* spp. were 8 to 11 in. and 12 to 14 in. high, respectively.

The results of cover-crop experiments showed conclusively that the condition of a maize crop growing in root-rot-infested soil is influenced materially by the preceding cover crop. Thus, following soy-beans the roots of maize were perfectly healthy, while following timothy [*Phleum pratense*] the reduction in growth and the diseased condition of the roots was even more severe than when maize followed maize. The other cover crops tested had an intermediate effect. In rotation, the best results were obtained when soy-beans immediately preceded maize, even when they followed upon timothy. Since the roots of soy-beans grown in artificially infected soil were found to be as susceptible to root-rot fungi as those of timothy, these results are taken to indicate that some factor other than parasitism must be involved in the effects derived from the various crops tested.

When species of *Pythium*, *Helminthosporium*, and *Fusarium* isolated from maize roots were inoculated into soil under controlled conditions at temperatures ranging from 9° to 29° C., it was found that at all but the lowest temperatures (9° to 11°) high soil moisture increased the growth of maize perceptibly over that of maize kept at lower moisture level. The lower ranges of temperature were generally found to favour the development of pathogens causing the most severe damage. *Pythium* spp. proved to be the most strongly pathogenic, causing an extreme reduction in growth of the host even at the highest temperatures, which are the optimal for the development of the host, and being also probably responsible for pre-emergence killing of seedlings. The general effect of *Helminthosporium* spp. was similar to, but less severe than that produced by *Pythium* spp., causing no appreciable pre-emergence killing except at the lowest temperatures. *Fusarium* spp. caused hardly any reduction in germination and only a slight reduction in growth of maize.

The type of injury to the plant varied with the parasite. Infection by *Pythium* spp.

affected all roots (but not the mesocotyl, unless the seed was destroyed), usually commencing at the apex and progressing rapidly as a light-coloured, watery soft rot, destroying first the cortical tissues and later the vascular system. Infection by *Helminthosporium* spp. gave the roots a dark brown or black and leathery appearance; it usually affected the scutellum and endosperm as well as the mesocotyl and most of the radicles and crown roots, frequently spreading upwards into the coleoptile and older leaves; beyond the infected areas the roots appeared to function quite normally. Infection by *Fusarium* spp. was considerably less serious, causing destruction of many laterals and the appearance of occasional brown lesions on the larger roots; in contrast to the fungi of the other two genera, it was favoured by high temperature combined with low soil moisture content, and was practically negligible at the lower ranges.

Elliott (Charlotte). **Relative susceptibility to Pythium root rot of twelve Dent Corn inbreds.**—*J. agric. Res.*, lxiv, 12, pp. 711–723, 5 figs., 3 graphs, 1942.

In inoculation experiments, carried out during 1940 and 1941 in the greenhouse at the Arlington Experimental Farm, Virginia, 12 inbred lines of Dent maize grown in sand and watered with nutrient solution were tested for resistance to *Pythium arrhenomanes* [*R.A.M.*, xiv, p. 94]. In both years the inbred Ia. L317 was the most resistant and C.I.1 the most susceptible of all. Thus the mean increase in height of control Ia. L317 plants was higher by 19 per cent. in 1940 and 34·4 per cent. in 1941 than that of inoculated ones, while the corresponding differences for C.I.1 plants were 77·8 and 77·4 per cent.; the green weight of the tops of control plants was higher by 11·1 and 58·1 per cent. than that of inoculated ones for Ia. L317 and by 96·5 and 94·5 per cent. for C.I.1; and finally, the weight of roots by 24 and 58·6 per cent. for Ia. L317 and 92·8 and 91·3 per cent. for C.I.1. The other lines tested occupied an intermediate position with regard to susceptibility. All inbreds were to some extent affected by the fungus, which destroyed the fine feeding roots.

Rhoads (A. S.). **The successful transmission of psorosis of Citrus trees in Florida by bark grafting.**—*Phytopathology*, xxxii, 5, pp. 410–413, 1 fig., 1942.

Particulars are given of the writer's successful experiments in Florida in the transmission of psorosis from diseased to healthy 28-year-old orange trees by means of patch bark inoculations, using pieces of diseased bark $\frac{3}{4}$ in. square, the typical bark symptoms appearing in six out of twelve cases after a three-year incubation period and making very little further progress during the next three years. These results substantiate those of Miss Doidge and Turner in the transmission of psorosis in South Africa [*R.A.M.*, xix, p. 86] and confirm H. S. Fawcett's demonstration of the agent as a virus [ibid., xviii, p. 248].

Dastur (R. H.). **How 'tirak' affects Punjab-American Cottons.**—*Indian Fmg*, iii, 4, pp. 181–183, 2 pl., 1942.

'Tirak', meaning 'bad opening of the bolls', is a physiological disorder of Punjab-American cottons characterized by foliar chlorosis, followed by reddening and shedding of the leaves and ultimately by the premature cracking of the abnormally small bolls, which contain only unripe seeds, poor-quality lint, and a low percentage of oil. In 1921, 1926, and 1928, when the trouble assumed a very intense form, the average yield for the Punjab of 5·2 maunds [1 maund = 82·284 lb.] per acre was reduced to 3, a serious consideration in view of the wide area (fluctuating from 1,000,000 to 1,500,000 acres from season to season) under cotton. In 1935, therefore, investigations on the etiology and control of the disease were commenced under the joint auspices of the Punjab Government and the Indian Central Cotton Committee and are still in progress.

Tirak is prevalent both on light sandy soils deficient in nitrogen and on sandy loams with abnormally large quantities of sodium salts in the upper subsoil. In the former class the nitrogen content of the foliage in September was shown by chemical analysis not to exceed 1·5 per cent. instead of the normal 2·5; at the same time accumulation of tannin in the leaves was giving rise to metabolic disorders. Foliar wilting and shedding and scantiness of boll production are more immediately associated with salinity of the subsoil, which interferes with the absorption of water by the roots and is actually toxic to the rootlets. Prolonged warm, dry spells in September and October tend to promote abnormally heavy losses of water even in normal non-saline soils, and the delay or omission of irrigation under such conditions may be attended by serious consequences.

VASUDEVA (R. S.). **Studies on the root-rot disease of Cotton in the Punjab, XI. Effect of mixed cropping on the incidence of the disease.**—*Indian J. agric. Sci.*, xi, 6, pp. 879–891, 2 pl., 2 graphs, 1941.

In further studies at the Lyallpur (Punjab) Agricultural Research Institute, supplemented by confirmatory trials at the British Cotton Growing Association Farm, Khanewal, on root rot of cotton (*Macrophomina phaseoli* and *Corticium solani*) [*R.A.M.*, xxi, p. 76], the incidence of infection was significantly reduced by intercropping the *Gossypium indicum* variety Mollisoni 39 with J. 20 sorghum, the best results (3 per cent. as compared with 69 in the control plots) being secured by the removal of the sorghum on 16th August, both crops having been sown on 16th May, 1939. The corresponding figures for the plots from which the sorghum was removed on 20th and 30th July and 10th August were 24, 19, and 20 per cent., respectively. Soil and air temperatures were lower and humidity higher in the mixed than in the pure cotton plots. Two American cotton (*G. hirsutum*) varieties, LSS and KT 25, interplanted with *Phaseolus aconitifolius*, gave higher yields than pure stands, the incidence of infection being reduced from 63 to 1 per cent. in the former and from 46 to 3 per cent. in the latter variety. Indian cotton likewise responded favourably to an admixture of *P. aconitifolius*, the amounts of root rot at Lyallpur in the pure and mixed plots being 55 and 2, and at Khanewal 52 and 2 per cent., respectively. *P. aconitifolius* may be withdrawn from the plots by 1st August. Interplanting with *Panicum colonum* and *Setaria italica*, especially the former, also tended to improve the health of Mollisoni 39.

TISDALE (H. B.) & DICK (J. B.). **Cotton wilt in Alabama as affected by potash supplements and as related to varietal behaviour and other important agronomic problems.**—*J. Amer. Soc. Agron.*, xxxiv, 5, pp. 405–426, 1 fig., 2 graphs, 1942.

The average incidence of cotton wilt (*Fusarium vasinfectum*) at various localities in Alabama in which experiments were conducted for three years and upwards ranged from 45 to 83 per cent. in the highly susceptible variety, Half and Half, and from 9 to 56 in the weakly tolerant group, including Cook 1138, Rowden 2088, Deltapine 12 and A, Delpress 3, Missdel 1 WR, and Miller 610. At six out of the nine test sites, no appreciable difference between the reactions of the resistant (including Cook 307, Cook Wiregrass, Dixie Triumph 12, Siker WR, and Clevewilt 6 and 7), and highly tolerant (Coker's 4 in 1, Dixie 14–5, Dixie Triumph 85, Toole, Cook 144–68, and Cook 1006) varieties could be discerned, but at the remaining three the former group was clearly superior to the latter. The increased severity of infection among the tolerant-resistant groups in two out of three localities may be attributed to potash deficiency (50 lb. or less replaceable potassium oxide per acre), while in the third root-knot nematodes were suspected of contributing to the virulence of the disease [*R.A.M.*, xix, p. 702].

The relatively constant ranking of cotton varieties with respect to wilt infection at the various experimental sites, regardless of the general severity of the disease, is

interpreted as evidence against the existence of physiologic races of the pathogen, matters of more practical concern to growers being the differential response of the varieties under observation to potash and the influence of seasonal and other environmental factors. In two localities where wilt was severe only on the susceptible (Farm Relief and Coker 100) and highly susceptible (Half and Half) varieties, increasingly heavy applications of potash (8 per cent. or more) gave good results, whereas at another place, where the disease was exceptionally virulent, such treatments were beneficial only to the resistant group, which responded equally well, however, on another site to moderate amounts, larger quantities being harmful. The Sea Island variety, for the one year in which it was included in the tests, was immune from wilt in one place and showed only a trace of vascular discoloration near the end of the season in another.

SIMPSON (D. M.). **Factors affecting the longevity of Cottonseed.**—*J. agric. Res.*, lxiv, 7, pp. 407–419, 1 graph, 1942.

In connexion with laboratory and field studies on the factors concerned in the longevity of cotton seed, the percentage of seedling mortality at Knoxville, Tennessee, among plants raised from seed previously stored for 2½ years was higher in the lots kept at 33° F. than in those held at 90°, air temperature (unregulated), or 70°, the cooler conditions apparently favouring the survival of the anthracnose fungus [*Glomerella gossypii*]. Thus, in the Carolina Dell variety, the incidence of mortality ranged from 2·8 to 14·9 per cent. at 33°, 0·0 to 1·9 at 70°, 0·7 to 1·8 at air temperature, and was nil at 90°, the corresponding figures for Deltapine A being 3·7 to 25·4, 0·0 to 0·7, 0·0 to 2·9, and 0·7 per cent. These data corroborate those (unpublished) secured by Arndt and Boozer at the South Carolina Agricultural Experiment Station. In the course of further field trials viable spores of *G. gossypii* and *Fusarium moniliforme* [*Gibberella fujikuroi*: *R.A.M.*, xxi, p. 331] were detected on seedlings from seed stored for 3½ years at 33°, but not on those from seed held at the higher series of temperatures.

FULLERTON (R. P.). **Methods of rot-proofing Cotton duck and canvas.**—*Irish Text. J.*, N.S., vii, 3, pp. 16–17, 1 diag., 1941.

Details are given of some processes which may be used as alternatives to the very complicated cuprammonium method of rot-proofing cotton duck and canvas [*R.A.M.*, xxi, p. 214]. A copper formate solution is prepared by the dissolution of 60 lb. copper sulphate in water, the resultant solution being mixed with one containing 40 lb. soda ash; a precipitate forms and is in turn dissolved in 2½ gals. 85 per cent. formic acid. A solution of aluminium formate is also prepared, consisting of 60 lb. aluminium sulphate, 50 lb. soda ash, and 4 gals. formic acid, and the cloth is impregnated with a mixture of the two solutions, dried, impregnated with dilute ammonia, and again dried.

C. Baswitz's patent (E.P. 16708–1889) is based on the fact that a solution of hydrate of copper oxide in spirits of sal ammoniac acts similarly to a solution obtained by the direct dissolution of copper in ammonia.

A simple treatment stated to be effective against mildew is carried out with the following ingredients: (1) 50 parts each of paraffin wax and wax-copper oleate (50 per cent. of each) and 10 parts each of oleine and rosin in (2) 140 parts of water, to which are added, after blending, (3) 20 parts of water, 10 each of ammonia and amoa O.M., and (4) 30 parts each of lime green and water and 10 of amoa O.M. A suitable fixing bath for the material thus treated consists of a mixture of 25 lb. copper sulphate in 200 water and 25 lb. lead oleate in 200 water acidified with acetic acid.

PETCH (T.). **Notes on entomogenous fungi.**—*Trans. Brit. mycol. Soc.*, xxv, 3, pp. 250–265, 1942.

This further contribution [*R.A.M.*, xviii, p. 736; xx, p. 301; xxi, p. 14] gives observations on 25 entomogenous fungi, including *Sorosporella uvella* (Krass.) Giard and its conidial stage *Syngliocladium cleoni* (Wize) Petch, n.comb. (syn. *Acremonium cleoni*

Wize), attacking wireworms (*Agriotes* sp.) at Rothamsted, and *Spicaria prasina* [ibid., xv, p. 719] found in Norfolk on a caterpillar attached to a grass leaf, the first European record of this fungus.

Lima (A. O.). **Os fungos do ar em alergia respiratória. I. Revisão da principal literatura sôbre o assunto. II. O papel dos Basidiomycetos. III. Métodos para seu estudo. IV. Os esporos de Alternaria e helminthosporos na atmosfera da cidade de Belo Horizonte.** [Atmospheric fungi in connexion with respiratory allergy. I. Review of the principal literature on the subject. II. The role of the Basidiomycetes. III. Methods for their investigation. IV. The spores of *Alternaria* and helminthosporiosis in the atmosphere of the city of Bello Horizonte.]—*Brasil-med.*, lv, 31, pp. 529–533; 32, pp. 549–552; 41, pp. 693–697; 46, pp. 759–760, 13 figs., 1 graph, 1941.

Many of the papers included in this useful review of the relationship of certain groups of fungi to respiratory allergy have already been noticed here from the original sources, but it may be of interest to mention two cases of asthma attributed to tomato leaf mould (*Cladosporium fulvum*), both in the United States (*J. Allergy*, iii, p. 389, 1932; *Ann. intern. Med.*, vi, p. 655, 1932) [besides those already reported: *R.A.M.*, xvii, p. 821]. Attention may further be drawn to the part played by species of *Hormodendrum*, *Mucor*, *Penicillium*, and *Alternaria* in the inducement of certain allergic conditions in Cuba, and to the seasonal fluctuations of these moulds (*Arch. intern. Med.*, p. 121, 1935; *Rev. med. Cirug. Habana*, xliv, p. 411, 1939) [cf. *R.A.M.*, xxi, p. 370 *et passim*].

Entirely negative results were given by tests in 1940–1 with various cereal rusts and smuts, reported from other countries as agents of bronchial troubles [ibid., xx, p. 406].

Directions are given for the collection and isolation in pure culture of some well-known atmospheric contaminants, with notes on their morphological characters.

Seasonal and meteorological conditions were found, in a study of mould incidence in the atmosphere of Bello Horizonte, Minas Geraes, to exert no influence on the development of *Helminthosporium* and *Alternaria* spp., to which few of the patients tested by intracutaneous injections proved to be sensitive.

Martin (D. S.). **Studies on the immunologic relationships among various species of the genus Candida (Monilia).**—*Amer. J. trop. Med.*, xxii, 3, pp. 295–303, 1942.

Further studies at the Duke University School of Medicine, Durham, North Carolina, on the antigenic features of various species of *Candida* by means of the agglutination, complement-fixation, precipitation, and precipitin absorption reactions with immune rabbit sera [*R.A.M.*, xix, p. 535] revealed antigenic differences between *C. albicans*, *C. tropicalis*, and *C. parakrusei* notwithstanding the marked cross reactions between the three species. *C. stellatoidea* and *C. albicans* are more nearly related, though material quantitative differences in the amounts of antigen present were observed. In the writer's opinion, this antigenic similarity does not justify the exclusion of *C. stellatoidea* from specific rank as a mere variant of *C. albicans*, among the reasons for its retention as a separate entity being the differences between the two species in respect of preference for certain sites, colony and microscopic morphology, sugar fermentation reactions, pathogenicity for rabbits, and response to dissociation with lithium chloride [ibid., xix, p. 595].

Neill (J. C.). **Ergot.**—*N.Z. J. Sci. Tech.*, A, xxiii, 3, pp. 131–137, 8 figs., 1941.

The ergots produced by *Claviceps purpurea* on six-rowed Cape barley, occasionally on wheat and oats, and on perennial rye grass (*Lolium perenne*) and other pasture grasses, including *Glyceria fluitans*, *Festuca arundinacea*, *Dactylis glomerata*, *Holcus lanatus*, *Ammophila arenaria*, *Poa pratensis*, *Agropyron scabrum*, *Bromus inermis*, and *L. multiflorum*, in New Zealand are elongated, horn-shaped, black outside, and milky-white in the interior, whereas those formed by *C. paspali* (on *Paspalum* only)

[*R.A.M.*, xxi, p. 337] are irregularly spherical and dusky or pinkish-white both in- and outside. In other respects the morphology of the two species is identical. Single plants of rye (which has not yet been found naturally infected in the country) were inoculated with conidial suspensions of 14 strains of *C. purpurea* from 12 hosts, of which only one, originating in a sample of commercial ergot from Hungary [ibid., xviii, p. 314], induced heavy and uniform infection, though mild symptoms were observed on plants treated with the wheat strain. In a field trial to determine the practicability of commercial ergot production by the artificial inoculation of rye, the total yields of air-dried material, computed on an acreage basis for 7 in. rows, sprayed once, twice, and thrice with suspensions of *C. purpurea* containing 550 conidia per ml., were 115, 140, and 176 lb. No alkaloid was present in the samples submitted to the Dominion Analyst.

CUNNINGHAM (I. J.). **The chemistry, pharmacology, and toxicology of ergot (Claviceps purpurea).**—*N. Z. J. Sci. Tech.*, A, xxiii, 3, pp. 138–145, 1941.

Two of the alkaloids known to occur in ergot (*Claviceps purpurea*) [see preceding abstract], viz., ergotoxin and ergotamine, are known to possess, in addition to their pharmacological and medicinal properties, toxicological principles which introduce an element of risk into their therapeutic use. Ergometrine [*R.A.M.*, xiv, p. 697], on the other hand, combines medicinal virtues with freedom from toxicity to human beings and livestock, and attempts should therefore be made to develop a race of the fungus in which the proportion of this alkaloid is greatly increased.

RUSCHMANN (G.) & BARTRAM (H.). **Untersuchungen über den Verderb von Flachsfasern und Leinengarnen durch bakterielle und pilzliche Schädlinge.** [Studies on the spoilage of Flax fibres and linen yarns by bacterial and fungal pests.]—*Zbl. Bakt.*, Abt. 2, cii, 12–14, pp. 300–323; 15–17, pp. 365–387, 9 figs., 1940.

Heavy microbiological contamination of flax fibres, yarns, and wooden spools in a large spinning works afforded an occasion for intensive studies at the Institute of Soil Science and Plant Nutrition, Landsberg-an-der-Warthe (Germany) on the identity and prevalence of the organisms concerned. Among the numerous fungi detected on the yarns *Alternaria tenuis* played the most prominent part, rapidly and severely attacking both pectin and cellulose, with resultant decomposition of the fibres. The only other fungus possessed of similar destructive properties was *Monilia sitophila*, which was, however, seldom present on the materials examined and need not be further considered as a pathogen. *A. tenuis* was already excessively widely distributed on the straw flax, so that its extensive occurrence on the dew-retted flax [*R.A.M.*, xxi, p. 370], and even on the processed yarns from this source was to be expected. On the other hand, the fungus was not abundant on the samples retted by the warm-water method or on the finished products from them. Green flax and the corresponding yarn appeared to be free from *A. tenuis* and in general to harbour few micro-organisms. Other fungi detected in varying numbers on untreated yarns included *M. candida* [*Candida vulgaris*], *Cladosporium herbarum*, *Penicillium luteum*, *Mucor plumbeus*, and *M. mucedo*.

Wooden spools with crumbling and sticky surfaces bore a complex and numerous microflora, largely consisting of yeasts and wood-destroying fungi, but also including *Fumago vagans*, *Cephalothecium* [*Trichothecium*] *roseum*, *Trichoderma lignorum* [*T. viride*], and *A. tenuis* (the spores of which were abundant). Within one to two weeks, under appropriate moisture conditions, sterilized or unsterilized yarn spun on contaminated spools was largely disintegrated, chiefly by *A. tenuis*.

Cooking, especially with dilute sodium lye, and bleaching with chlorine reduced the incidence of fungal infection on yarn to insignificant proportions. In a moist chamber the moulds and yeasts succumbed to five minutes' exposure to a temperature of 80° C.

or one minute at 100°, in contrast to the bacteria concerned in the decomposition of the fibres, for the destruction of which a period of ten minutes at 100° was requisite.

CASS-SMITH (W. P.). **Flax rust.**—*J. Dep. Agric. W. Aust.*, Ser. 2, 1, pp. 56–63, 4 figs., 1942.

Small areas of flax and linseed have been grown in many parts of Western Australia during the last thirty years, but cultivation on a large scale was not attempted until the outbreak of the present war. During the last two seasons, all seed for flax- or linseed-growing imported into Western Australia by either the State or the Commonwealth Government was carefully cleaned and treated with an organic mercury dust under departmental supervision before dispatch to farmers.

In August, 1941, Blue Riga linseed in the Northam area was attacked by an epidemic of rust (*Melampsora lini*) [*R.A.M.*, xxi, p. 256]. The affected plants were the second crop from a line of commercial seed bought locally in 1940. The seed had not been cleaned or dusted in either year, and both crops had been grown on the same land. Later virtually all the linseed crops in the Northam and adjacent areas developed the disease, but on the whole the damage was only slight. Afterwards a trace of rust was found in crops of fibre flax in certain south-western districts, including the Wokalup, Preston Valley, Bonnybrook, Harvey, and Yarloop areas. Flax rust has been recorded from all States of the Commonwealth, with the possible exception of Queensland. It was first reported in Western Australia in 1931, when a small plot of flax in the East Pingelly district was badly affected. It was not again observed until 1941.

The fungus attacks only cultivated and wild flax. Two species of the latter are found in the State, *Linum marginale* and *L. gallicum*. The former is indigenous and widely distributed throughout the south-west, while the latter is an introduced species and chiefly confined to the Vasse district. The disease has been reported on *L. marginale* in most of the eastern States of Australia, but it was not until the author recently examined some 'wild flax' specimens from the State Herbarium that typical symptoms of flax rust were discovered on a local plant of this species. This specimen was collected in the Wagin area in 1920, and as far as can be ascertained this is the first record of the disease on 'wild flax' in Western Australia.

Observations last season showed the most susceptible variety to be Blue Riga, followed in descending order of susceptibility by (2) Punjab, (3) Concurrent and Liral Crown, (4) Bison, and (5) Ottawa. The varieties locally grown appeared to be only slightly affected, not because they are resistant, but because early planting enables them to escape more serious damage. Until varieties of proved resistance can be introduced, all seed should be graded and cleaned, and the screenings burned. It should also be treated with ceresan or agrosan at the rate of 3 or 4 oz. per bush. of seed. Arrangements have been made for all seed issued to contract growers for this year's cropping to be cleaned and dusted before dispatch. Seeding should occur as early as possible within the correct period for each district, so that the crops may be well advanced in growth when liability to attack begins in the spring.

MAINS (E. B.). **Phlox resistant to powdery mildew.**—*Phytopathology*, xxxii, 5, pp. 414–418, 2 figs., 1942.

At intervals since 1933 the writer has been engaged on a study of varietal reactions to powdery mildew (*Erysiphe cichoracearum*) of perennial phlox (*Phlox paniculata* and *P. maculata*) at Ann Arbor, Michigan, the investigation having been extended in 1935 to the annual *P. drummondii* [*R.A.M.*, xvi, p. 255]. A high degree of resistance was shown by the perennial selections of various colour types H1, DP4, DP19, DP20, and DP24 in 1934, 1935, and 1937, which broke down, however, in the severe epidemics of 1938 and 1941 (except in the case of DP4 in the latter year); the commercial varieties Miss Lingard and Columbia were moderately to very susceptible throughout the period of the tests. Of the *P. drummondii* selections, the large-flowered, pomegranate-

purple to rose-red (Ridgway), white-eyed strain No. 67–25 was the most promising, all the 91 plants inoculated in the greenhouse in 1941 being highly resistant, whereas 168 of a commercial line were susceptible. The occurrence of several physiologic races of phlox mildew was indicated by the field evidence of 1938 and 1941.

Jenkins (Anna E.). **A new species of Sphaceloma on Poinsettia.**—*Proc. biol. Soc. Wash.*, lv, pp. 83–84, 1942.

*Sphaceloma poinsettiae* n.sp. is the name applied to the causal organism of scab on poinsettia (*Euphorbia pulcherrima* var. *plenissima*) in Florida and Hawaii [*R.A.M.*, xxi, p. 371], *E. poinsettia* also having shown mild infection in the former locality. The spots on the leaf veins are raised, pale buff with a purple to nearly black margin, up to 4 by 2 mm.; those on the laminae are circular, raised below and concave above, pale buff to liver-brown (Ridgway), up to 3 mm. in diameter; and those on the margins roughly hemispherical, causing an inward rolling of the leaf. Stem cankers are numerous, circular to elliptical or elongated, raised, tending to sink in the centre, pinkish-buff, sometimes purple-edged with a red or purple surrounding zone, 1 mm. to 1 cm. by 1 to 8 mm., becoming confluent and girdling the stem, causing death of the upper portion.

The conidiophores, arising from a stroma composed of hyaline to pale yellow hyphae, are continuous to uniseptate, pale to brown, 15 to 30 by 3 to 5 $\mu$, and produce elliptical to oblong, occasionally cylindrical or spherical, simple or uni-, rarely biseptate, conidia of a similar colour to the conidiophores, 7 to 20 by 2·5 to 5·3 $\mu$, forming over the lesions an inconspicuous grey to olive-brown coating.

Jenkins (Anna E.) & Bitancourt (A. A.). **An Elsinoe causing an anthracnose of Virginia Creeper.**—*Phytopathology*, xxxii, 5, pp. 424–427, 1 fig., 1942.

*Elsinoe parthenocissi* n.sp. is the name applied to a fungus causing a destructive anthracnose of the leaves, stems, and fruits of Virginia creeper (*Parthenocissus quinquefolia*) near Marlboro, New Hampshire, and found to be identical with herbarium material of the same disease collected by A. W. Chapman in Florida in 1891. The organism is characterized by a hyaline to faintly yellowish pseudoparenchyma of isodiametric, fairly thick-walled cells; ascomata 70 to 160 $\mu$ in diameter and 35 to 80 $\mu$ in thickness; and mostly globose asci with a thin outer and thick inner wall, 17 to 25 $\mu$ in diameter, each containing eight triseptate, straight or somewhat curved spores, 12 to 17 by 6 to 8 $\mu$, these dimensions exceeding those of *E. ampelina* [*R.A.M.*, ix, p. 66], the only other species of *Elsinoe*, besides *E. viticola*, known on Vitaceae.

The pathogen produces on the leaves varying numbers of well-defined, subcircular to circular, occasionally irregular, vinaceous-brown, clove-brown (Ridgway) -bordered lesions, 0·2 to 4 mm. in diameter, tending to fall out with a shot-hole effect; on the stems and petioles raised, pale, dark-edged cankers; and on the fruits greyish-white spots (as defined by Alma E. Waterman) [ibid., xxi, p. 53].

Ramsbottom (J.). **Gloeosporium nicolai Aggéry and Gloeosporium polypodii Aggéry.**—*Trans. Brit. mycol. Soc.*, xxv, 3, p. 334, 1942.

The author states that Mlle B. Aggéry's drawings and descriptions of *Gloeosporium nicolai* on *Scolopendrium officinale* and *G. polypodii* on *Polypodium vulgare* and on *P. vulgare* var. *serratum* [*R.A.M.*, xv, p. 809] show the former to be *Milesia* (*Milesina*) *scolopendrii* and the latter to be *Milesia polypodii* (*Milesina dieteliana*), while a form of *G. polypodii* on *Aspidium aculeatum* is probably *Milesia whitei* [cf. ibid., xvi, p. 63].

Gray (Elizabeth G.). **Phialea mucosa sp. nov., the blind-seed fungus.**—*Trans. Brit. mycol. Soc.*, xxv, 3, pp. 329–333, 1942.

In the course of studies on low germination in rye-grass (*Lolium perenne* and *L.*

*multiflorum*) the author noted the resemblance between the 'blind seed' fungus [*R.A.M.*, xx, p. 122; xxi, p. 2] and *Endoconidium temulentum*. The perfect stage has been assigned in turn to *Phialea*, *Stromatinia*, and *Sclerotinia*. Measurements of apothecia, ascospores, and microconidia agree closely in the two fungi, and the microconidia in all are developed endogenously. Macroconidia have not been described for *Sclerotinia temulenta*. Flowering rye has been successfully inoculated with the 'blind seed' fungus, but apothecia have not yet been obtained from infected rye grains.

The 'blind seed' fungus is an inoperculate Discomycete which has features in common with *Sclerotinia*, *Ciboria*, *Helotium*, *Phialea*, and *Stromatinia*. Anatomical examination was made of fresh or dried material of representative species of all these, and showed that the anatomy of the apothecium provides a very reliable taxonomic character. The structure of the apothecium of the 'blind seed' fungus is very uniform, and consists throughout of parallel hyphae, forming a typical 'textura porrecta', with a very slight tendency to irregularity in the centre of the excipulum immediately under the hypothecium. In *Sclerotinia*, *Stromatinia*, and *Ciboria* the excipulum consists of two layers, the inner of a loose 'textura intricata' of slender hyphae, and the outer of wide hyphae which form a 'textura oblita'. In *Phialea* the excipulum consists of slender parallel hyphae which form a 'textura porrecta' in the stalk and merge into a 'textura oblita' under the hypothecium.

The 'blind seed' fungus agrees fairly closely in structure with species of *Phialea* and differs strikingly from the other genera. The fungus is therefore assigned to this genus, and is named *P. mucosa* n.sp.; this conclusion is, however, tentative until the relation of the fungus with *S. temulenta* has been established or disproved.

*P. mucosa* n.sp. is described as having small, fleshy apothecia arising singly or 1 to 7, usually 1 or 2, from colourless, septate intertwining hyphae, 3 to 4 $\mu$ in diameter, ramifying through the pericarp, testa, and endosperm; pale pinkish-cinnamon disks darkening to cinnamon when old, 1 to 3·5 (most frequently 2·5) mm. in diameter, at first almost closed, opening into a cup shape and finally becoming flat or slightly recurved, with a smooth margin; smooth, cylindrical stalks, 1 to 8 mm. long, 0·4 mm. in diameter, with a structure fairly uniform, consisting of parallel hyphae occasionally intertwining and seldom branched, forming a 'textura porrecta', with cells in the stalk 20 to 30 by 3 to 4 $\mu$, grading into the more interlaced hyphae of the excipulum, with cells 18 to 24 by 4 to 6 $\mu$, passing gradually into the hypothecium, which is 22 to 27 $\mu$ deep and composed of fine, interlacing hyphae 2 $\mu$ in diameter. The 8-spored, cylindrical-clavate asci, 66 to 116 by 3·3 to 7 $\mu$, most frequently 73 by 6 $\mu$, are very little thickened at the apex, and the pore does not stain blue with iodine; the smooth, unicellular, ellipsoidal ascospores have pointed ends and measure 7·6 to 12 by 3 to 6 $\mu$, most frequently 9·5 by 4·5 $\mu$; they lie obliquely uniseriate in the upper half to three-quarters of the ascus; on germination each ascospore produces first a terminal germ-tube and then a second, frequently lateral and usually constricted at the point of origin; the paraphyses are simple, filiform, hyaline, 2 to 4 $\mu$ broad, not swollen at the apex.

The cylindrical to slightly crescentic macroconidia have rounded ends and measure 11 to 21 by 3·3 to 6 $\mu$, most frequently 16 by 4 $\mu$. They are formed in large numbers from the apices of short outgrowths from hyphae on the pericarp, producing a pink slime on the surface of the ovary. The microconidia occur in pink, pulvinate sporodochia, 1 to 1·5 by 0·5 mm., on the surface of caryopses; the conidiophores are septate, hyaline, and two or three times branched; the microconidia are unicellular, uninucleate, ovoid, hyaline, and measure 3·4 to 4·8 by 2·7 to 3·2 $\mu$, most frequently 4 by 3 $\mu$, the first formed by a constriction below the apex of the conidiophore, the remainder developed successively in a tube measuring 5 by 3 $\mu$ formed by the terminal portion of the conidiophore. Germination was not observed. The apothecia were found on dead or occasionally germinated caryopses of *Lolium perenne* and *L. multiflorum* in June, the macroconidia on the ovary throughout the summer, and the microconidia on caryopses on the soil usually in February and March, occasionally until June.

KEARNS (H. G. H.) & MARSH (R.W.). **A summary of fruit spraying programmes: 1942 revision.**—*Rep. agric. hort. Res. Sta. Bristol, 1941*, pp. 59–69, [1942].

In this paper the standard spray programmes recommended to fruit growers in the Bristol Province in 1936 [*R.A.M.*, xvi, p. 817] are revised and brought up to date.

PLAGGE (H. E.). **Controlled atmosphere storage for Jonathan Apples as effected by restricted ventilation.**—*Refrig. Engng*, xliii, 4, pp. 215–220, 2 figs., 2 graphs, 1942.

At the Iowa Agricultural Experiment Station the storage of comparable samples of Jonathan apples at 31° to 32° and 35° to 36° F. at carbon dioxide levels of 7, 9, and 11 per cent. increased the marketable storage period of the fruit over that of air-stored samples by three to four months, the corresponding period for a 3 to 4 per cent. carbon dioxide concentration being two to three months [*R.A.M.*, xxi, p. 82]. The carbon dioxide-treated fruit was of a firmer texture, more attractive colour, and better eating quality than the controls, and Jonathan spot was absent. Storage under conditions of restricted ventilation did not enhance the tendency to scald, but at 32° and the two upper carbon dioxide levels, brown heart and soggy breakdown developed.

SMOCK (R. M.) & SOUTHWICK (F. W.). **Some factors affecting Apple scald disease.**—*Science*, N.S., xcv, 2475, pp. 576–577, 1942.

In two years' experiments with Rhode Island Greening apples promising results in the control of scald [*R.A.M.*, xxi, p. 82] were obtained by coating the fruit with a wax emulsion (brytene 489 AM). With prematurely picked apples control was less good than that given by oiled paper, but with pickings made at the normal time it was equally good. Waxing keeps the fruit in greener crisper condition than oiled paper, and it is suggested that small commercial trials of this treatment should be made, using 6 to 8 per cent. solids in the emulsion.

Volatile products from one lot of apples may induce scald on a second lot [ibid., xviii, p. 117]. Susceptible varieties scald much sooner and more severely in the presence of volatiles from McIntosh apples than when stored alone, both in ordinary cold storage and in atmospheres in which the carbon dioxide and oxygen levels as well as temperature and humidity were controlled.

Progress has been effected in conditioning storage atmospheres to rid them of the harmful volatiles, using various oils and activated charcoal. Failure to obtain complete control is attributable partly to lack of knowledge as to when the absorbents become saturated.

FAES (H.), STAEHELIN (M.), & AUBERT (P.). **Recherches sur la conservation des Pommes et des Poires.** [Studies on Apple and Pear preservation.]—*Annu. agric. Suisse*, lvi, 3, pp. 207–277, 7 figs., 8 graphs, 1942. [German summary.]

Included in this comprehensive, fully tabulated account of studies which have been in progress since 1933 at the Federal Viticultural and Arboricultural Experiment Station, Lausanne, on the keeping qualities of apples and pears under various conditions of storage (refrigerator, cellar, and open air) are numerous references to the disorders incidental to the different varieties used in the tests. The development of fungal rots, e.g., *Penicillium*, *Mucor*, *Botrytis*, and *Rhizopus* spp. [*R.A.M.*, x, p. 801], may be prevented by regular fungicidal treatments throughout the growing season, careful selection of exclusively sound fruits for the storage room, and the annual fumigation of the latter with sulphur (10 to 20 gm. per cu. m.) or formalin at the rate of 20 c.c. plus 20 c.c. water and 8 gm. potassium permanganate per cu. m. Internal breakdown chiefly affects the White Calville, Red Rome Beauty, Jonathan, and Mans Pippin apple varieties stored at a temperature round about 0° C., the damage at 3° to 4° being much less serious. Susceptibility to scald is most in evidence in the Canadian and Grey Pippins, Beurré Six, Louise Bonne, Doyenné d'hiver, and Clairgeau. Lenticel spotting, the form of scald so prevalent in England [ibid., xviii, p. 116], is relatively

infrequent on the apple varieties chiefly cultivated in Switzerland, but occurs on the Pineapple, Landsberg, and Mans Pippins. In general, a temperature between 2° and 4° and a humidity of 85 to 90 per cent. constituted the most favourable atmosphere for the cold storage of apples in these experiments. The application immediately prior to storage of a wax coating to such rough-skinned varieties as Beauty of Boskoop and Canadian Pippin is recommended as a precaution against wrinkling.

McKay (R.). **Apple scab and its control at Glasnevin in 1939, 1940 and 1941.**—*J. Dep. Agric. Éire*, xxxix, 1, pp. 46–79, 6 pl., 1 diag., 1942.

Further spraying tests carried out in Éire against apple scab (*Venturia inaequalis*) [*R.A.M.*, xviii, p. 531] from 1939 to 1941 are described. In the first two seasons the weather was unfavourable to infection, but a considerable amount of scab developed on trees that had not been sprayed for some years. In 1941 infection was severe, although less rain fell during the growth season than had been the case in 1939 and 1940. The severity of the 1941 outbreak is attributed to the fact that March and April were wet, and during these months scab pustules on the bud scales reached a maximum state of development, to cold winds at flowering, which was nearly one month later than normal, foliage development being retarded at a very susceptible stage, and thirdly, to lack of sunshine in summer.

Ascospore infection is believed to have been eliminated during these tests. Scabbed one-year-old wood contributed to infection only in 1939. In each year, the chief source of initial infection was infected bud-scales. In the spring, the presence of this source of infection is indicated by characteristic outbreaks on rosette leaves and those surrounding the flower trusses.

Primary infections on the under sides of the foliage were conspicuous on an Allington Pippin tree in 1941, and resulted from contact between the developing leaves and diseased bud-scales, subsequent growth carrying the contaminated point beyond the source of infection. This type of primary undersurface infection has generally been attributed to wind-borne ascospores coming into contact with the dorsal leaf surface, which is first exposed from the bud. The cumulative effect of the disease on Bismarck takes the form of badly infected foliage, reduced current season's growth, premature defoliation, fewer fruit buds, and worthless fruit.

One pre-blossom application of lime-sulphur (1 in 30 or 1 in 40) and two post-blossom applications of the same (1 in 60 or 1 in 80) on Allington Pippin, Bramley's Seedling, King Edward VII, and Gascoyne's Scarlet apples resulted in over 95 per cent. clean fruit in 1939 and 1940, and over 90 per cent. in 1941. One pre-blossom application of Bordeaux mixture (2–6–40) and two post-blossom treatments (2–6–40 and 1–3–40) on Bramley's Seedling gave a higher percentage of clean apples each year than three corresponding applications of lime-sulphur, the differences being greatest in 1941. The evidence showed that where the disease has been kept well in check, a green-bud spray, whether of lime-sulphur or Bordeaux mixture, is superfluous. The second post-blossom spray is more important. Highly susceptible varieties, such as Bismarck and Annie Elizabeth, may require more than two post-blossom sprays. Lime-sulphur injury results in scorching, checking, and crippling of the young foliage, but these effects are less lasting than the damage due to Bordeaux mixture, which consists in fruit-russeting and leaf-hardening; in 1941, a secondary effect of Bordeaux spray on Bramley's Seedling trees was the production of premature leaf fall.

Singh (U. B.). **The soft-rot of Apple fruit in Kumaun.**—*Indian J. agric. Sci.*, xi, 6, pp. 902–905, 13 figs., 1941.

*Penicillium expansum*, the agent of a soft rot of stored apples, first recorded for India at Chaubattia (United Provinces) in 1934, then in Baluchistan [*R.A.M.*, xv, p. 587], and now in Kumaun, produces on the fruits of Delicious and other varieties

watery, light or yellowish-brown areas, on which, under conditions of extreme humidity, a bluish-green sporulating growth develops. Infection may also originate at the stem and calyx ends. A characteristic musty odour is given off from diseased fruit. The rot may cause substantial losses of up to 75 per cent. Particulars are given of the symptoms of the disease and the morphology of the fungus. The results of inoculation experiments on Bramley's Seedlings indicated that the pathogen can enter only through skin injuries, which should be avoided by the observance of stringent precautions in picking (including the use of gloves if necessary), grading, and packing; the fruit should be wrapped with wrappers treated with double-boiled linseed oil, and in packing the pad of wrapping paper should be placed so as to minimize the risk of contact between the stem of one fruit and the epidermis of another. Fruit showing the least sign of skin injury or rotting should be removed.

Wilkinson (E. H.). **A note on the so-called dry eye rot of Apples associated with Botrytis cinerea Pers.**—*Rep. agric. hort. Res. Sta. Bristol, 1941*, pp. 72–75, 1 pl., [1942].

Observations on a large number of apples affected with the 'dry eye rot' disease associated with *Botrytis cinerea* [*R.A.M.*, xx, p. 169; xxi, p. 259] showed that the development of infection falls into three stages. In the first, a slight redness appears at the base of one or more calyx segments towards the end of July. The reddened area expands slowly in a radial manner away from the calyx, leaving light brown skin behind. Expansion is slow, and was observed in some cases to continue until the first week of September. By this time, the lesions range from $\frac{1}{2}$ to 1 in. in diameter. Internally, the tissues to a depth of $\frac{1}{10}$ in. beneath the discoloured skin are soft, water-soaked, and light brown.

In the second stage, the lesions cease growing and dry out. The overlying skin subsides and turns dark brown or black. It assumes a stretched, parchment-like appearance, often becoming detached from the surrounding healthy skin at the periphery. Internally, the water-soaked tissues dry out and become tough. At this stage, the lesions are approximately circular and either surround the calyx or, more often, are situated on one side of it. Their periphery is clearly defined, and is surrounded by a thin band of red skin.

The lesions remain in the quiescent condition reached at the end of the second stage for a few weeks. Then, in October and November the third stage sets in; the healthy skin immediately surrounding the lesions becomes light brown and spreads, until after about 14 days the whole apple is involved in a soft rot of the *B. cinerea* type. Isolations made from apples showing rot in stages one and two gave pure cultures of *B. cinerea.* Inoculations of apples through pricks in the laboratory, produced typical *Botrytis* rots, but when the process was repeated at the base of calyx segments of Laxton's Superb apples (which appear to be the most susceptible) while on the tree, either total rots or complete failure to take resulted.

Affected apples may carry the fungus into storage. A count of a sample of Laxton's Superb apples in September, 1941, showed 178 fruits to be infected with dry eye rot. On 30th October, 123 or 69·1 per cent. were completely rotted, and in a few instances the infection had spread to adjacent healthy apples. The disease is most prevalent after a wet July or August. If attack by *B. cinerea* is to be kept at a minimum, it is essential that all fruits with dry eye rot should be immediately discarded.

Roach (W. A.). **The use of plant injection in plant pathology.**—*Trans. Brit. mycol. Soc.*, xxv, 3, p. 338, 1942.

The author states that in the course of his plant injection studies [*R.A.M.*, xviii, p. 539; xix, p. 283] apple shoot treatment with sodium thiosulphate has controlled *Podosphaera leucotricha*, and injection of plum trees with a disinfectant or a nutrient has cured silver leaf (*Stereum purpureum*), at least temporarily.

LANGFORD (M. H.) & KEITT (G. W.). **Heterothallism and variability in Venturia pirina.** —*Phytopathology*, xxxii, 5, pp. 357–369, 3 figs., 1942.

It is concluded from the results of a genetic study on the pear scab fungus, *Venturia pirina*, at the Wisconsin Agricultural Experiment Station, a preliminary account of which has already been noticed [*R.A.M.*, xix, p. 548], that the species is composed of numerous biotypes differing in morphology and pathogenicity. The inheritable variations in these characters arise from fertile unions between members of the two groups of hermaphroditic but self-incompatible thalli.

MITTMANN-MAIER (G[ERTRUD]). **Untersuchungen über die Anfälligkeit von Apfel- und Birnensorten gegenüber der Moniliafruchtfäule.** [Studies on the susceptibility of Apple and Pear varieties to *Monilia* fruit rot.]—*Gartenbauwiss.*, xv, pp. 334–361, 1940. [Abs. in *Hort. Abstr.*, xii, 2, p. 89, 1942.]

From 1937 to 1939, observations were made at the Geisenheim (Rhine) Horticultural Research Station in September and October on the ripe fruits of 158 apple and 111 pear varieties inoculated with *Monilia* [*Sclerotinia*] *fructigena* and *M. cinerea* [*S. laxa*: see next abstract]. The most resistant apple varieties were Rheinischer Bohn, Pomeranzen, Zwiebelborsdorfer, Roter Winterstettiner, Gelber Winterstettiner, Medina, and Ribston Pippin, while the most resistant pear was the Station-bred Sämling Muth, followed by Gestreifte St. Germain, Olivier de Serres, Edelcrassane, Souvenir de Constantin Bernard, Charles Cognée, and Schöne [Belle] Angevine.

MAIER (W.). **Ueber ein Zweigsterben der Aprikosen als Folge von Monilia-Fruchtfäule.** [On an Apricot branch die-back as a sequel to *Monilia* fruit rot.]—*Z. PflKrankh.*, lii, 2–4, pp. 91–107, 12 figs., 1942.

During the summer of 1941, apricot trees at and near the Geisenheim (Rhine) Horticultural Research Station were observed to be suffering from a destructive die-back of the branches caused by *Monilia cinerea* [*Sclerotinia laxa*] and *M.* [*S.*] *fructigena*, and closely resembling a cherry disease already described from the same locality [*R.A.M.*, xx, p. 24]. In many cases the entire crown of the tree was involved and had to be removed. Infection was found to originate in the fruits, whence the mycelia of the pathogens proceeded through the pedicels into the branches, where it spread through the phloem and xylem, obstructing the supply of water to the leaves by the accumulation of hyphae, formation of tyloses, and the deposition of gum, and causing the cessation of cambial activity or even the dissolution of the cambium.

The cherry disease previously reported (which also affects apricots) is almost exclusively associated with *S. laxa*, and a cultural study was therefore made to confirm the presence of *S. fructigena* in the infected material. The morphology of the mycelium and conidia left no doubt as to the identity of the pathogen, the conidial dimensions of the strain from apricot measuring $21{\cdot}2\pm0{\cdot}16$ by $13{\cdot}2\pm0{\cdot}10\ \mu$, compared with $19{\cdot}2\pm0{\cdot}18$ by $12{\cdot}7\pm0{\cdot}29$ and $20{\cdot}4\pm0{\cdot}17$ by $13{\cdot}8\pm0{\cdot}13\ \mu$ for isolates of *S. fructigena* from cherry and apple, respectively, and $15{\cdot}9\pm0{\cdot}15$ by $11{\cdot}0\pm0{\cdot}12$ and $15{\cdot}3\pm0{\cdot}15$ by $10{\cdot}7\pm0{\cdot}11\ \mu$ for strains of *S. laxa* from peach and apricot mummies, respectively. It is evident from these observations that the scope of *S. fructigena* is not limited to the fruit in Germany, as heretofore assumed.

Among the varieties most susceptible to the *Sclerotinia* die-back are the Pineapple, Jony, Nancy, Syrian, Moorpark, and Royal, while a high degree of resistance was shown by 15, including Goutte d'Or and Ambrosia, and nine were of intermediate reaction, among them Red Muscadine and Triumph of Treves. The development of varieties resistant to the pathogens will, in all probability, be the final solution of the control problem, and evidence is presented by the writer (in a forthcoming paper in *Angew. Bot.*, 1942) of hopeful possibilities in this direction. The timely removal of all infective material from the trees is beset with great practical difficulties, but in addi-

tion to the excision of all dead twigs (in which the fungi overwinter), the feasibility of early harvesting, before the fruits are extensively involved, should be considered.

DENHAM (H.) & WORMALD (H.). **The brown rot diseases of the Apricot.**—*J. R. hort. Soc.*, lxvii, 8, pp. 261–263, 1942.

One cause of apricot die-back in England is infection by *Monilia cinerea* [*Sclerotinia laxa*] [*R.A.M.*, xix, p. 602], which is found on flowers and young leaves, in the tissues of the affected twigs, and on the fruit. Infection arises from spores shed from fructifications on dead twigs and spurs and mummified fruits left on the tree from the previous year. The fungus infects the blossom producing wilt, spreads to the twigs giving rise to twig blight, and later attacks the fruit, causing brown rot. Infection generally begins at wounds made by insects or birds, but may arise through an affected fruit touching a healthy one. *S. fructigena* also attacks stone fruits, including apricots [see preceding abstract], but is not known to infect the flowers.

For control purposes, growers are advised to try a tar-oil spray as late as possible in winter, but before the buds begin to swell. Spraying should be carried out just before the flowers open with Bordeaux mixture, using 10 oz. copper sulphate and 15 oz. hydrated lime per 10 gals. water. Infected twigs and spurs should be cut out, preferably two or three weeks after blossoming.

WORMALD (H.). **Bacterial diseases of stone-fruit trees in Britain. VIII. Bacterial canker of Peach.**—*Trans. Brit. mycol. Soc.*, xxv, 3, pp. 246–249, 3 figs., 1942.

Continuing his studies on bacterial diseases of fruit trees in Britain [*R.A.M.*, xviii, p. 122], the author states that peach bacterial canker was observed in May, 1927, but has never been found since. Only one tree was affected, a Hale's Early, grafted on Black Damas C. Die-back was present, one side being nearly dead, and the cortex brown along the entire length of the main branch. The affected cortex was found to contain an organism which in its main characters agreed with *Pseudomonas mors-prunorum* [ibid., xxi, p. 25], to which it is referred; inoculations with it into peach, plum, and cherry branches resulted in typical bacterial cankers.

The chief characters common to the peach organism and other strains of *P. mors-prunorum*, and distinguishing them from *P. prunicola* were as follows: in nutrient broth + 5 per cent. saccharose and in Uschinsky's solution a white cloudy growth without any yellowish tint; on nutrient agar+5 per cent. saccharose a rapid production of acid, usually with death in four to six days; and on nutrient agar+2 per cent. lactose, with bromo-cresol purple as indicator, an alkaline, later acid reaction, the medium turning yellow.

The strains of *P. mors-prunorum* that have come under study vary among themselves in their reaction when grown in milk cultures. Typically, they produce a solid curd with an acid reaction (yellow in milk containing bromo-cresol purple), but with a little whey above the curd. After six months the peach strain gave the following reactions: in plain milk, indistinguishable from control tubes in colour and consistency, except for a trace of precipitate; in litmus milk, a trace of precipitate, and colour somewhat deeper than controls; in milk with bromo-cresol purple, a very slight change towards acidity, but no curdling; and in methylene blue milk, eventually greenish (dark bluish glaucous of Ridgway). The characters in which the peach strain deviates from the type in milk cultures are not regarded as having any specific significance.

McCOLLAM (M. E.). **Prune trees need plenty of potash.**—*Bett. Crops*, xxvi, 2, pp. 15–18, 38–40, 10 figs., 1942.

Prune trees in California tend to suffer from potash deficiency, expressed by stunted, severely scorched, chlorotic foliage and small, 'sunburnt' fruit, among the soils giving rise to this trouble being Pinole loam, Rincon clay loam, and Conejo clay adobe. The four-year average yield in orchard plots of dried fruit of French prune trees treated with sulphate of ammonia and sulphate of potash ($2\frac{1}{2}$ lb. actual potassium oxide per

tree) was 4,210·5 lb. per acre compared with 2,282·7 for the control, the corresponding figures for 1941 being 5,706 and 2,844 lb., respectively. Sugar prunes over a four-year period gave an average yield of 2,140·3 lb. per acre in response to borax compared with 1,473·7 for the control, the corresponding figures for 1941 being 2,025 and 1,422 lb., respectively. The yields of green fruit from borax-treated French prune trees in 1939 and 1940 were 5,831·2 and 7,827·1 lb. per acre, respectively, while the controls yielded 881·2 in 1939 and a worthless crop in 1940. Leaf analyses in 1940 revealed a potassium content of 0·99 and 0·34 per cent. in the treated and untreated trees, respectively, with residues in 1941 of 0·77 and 0·2 per cent., respectively. In 1940 the leaf contents in potassium of two rows of newly planted French prunes receiving nitrogen and phosphorus, potash alone, and nitrogen-phosphorus-potash were 1·04, 1·84, and 2·19 per cent., respectively, as against 1·58 for the untreated controls, the corresponding figures for 1941 being 1·02, 1·50, 2·08, and 1·38 per cent., respectively, indicating that potash enters the tree more readily in the company of nitrogen and phosphorus than alone, whereas these two elements without potash reduce the potash content below that of the untreated trees. Generally speaking, a potassium content in the foliage of under 1 per cent. is expressed by deficiency symptoms, which are apt to become acute with a further drop below 0·5 per cent. It may well be desirable, from the standpoint both of quantity and quality, to build up the potassium levels in prune foliage to 2½ per cent.

THOMAS (H. EARL). **Transmissible rough-bark diseases of fruit-trees.**—*Phytopathology*, xxxii, 5, pp. 435–436, 1 fig., 1942.

Among the comparatively unfamiliar rough-bark group of virus diseases affecting fruit trees in central and northern California may be mentioned those of the diamond canker type [*R.A.M.*, xxi, p. 83] on apricot, cherry, plum, prune, and the Pink Radiance rose variety, all of which persist in scions: cankers very similar to those on prune have also been collected by H. N. Hansen on alder (*Alnus? rhombifolia*). Citrus psorosis [see above, p. 449] is another member of this group. A disorder of Gravenstein apple, known locally as 'flat limb' or 'crinkle wood', is characterized by irregularities in wood development but may be included in this group also because of the rough-bark symptoms produced when graft inoculations are made on *Pyracantha gibbsii yunnanensis*. Bosc pears may show symptoms not greatly unlike those of the Gravenstein disease; they also suffer from measles, oak bark (involving excessive sloughing), stony pit [ibid., xviii, p. 463], and a disease similar to or identical with the last-named, inducing no fruit symptoms when top-worked on the Bartlett, Comice, and Hardy varieties, but causing a foliar mosaic in Hardy.

MILBRATH (J. A.) & ZELLER (S. M.). **Rough-bark, a virus disease of flowering Cherry.**—*Phytopathology*, xxxii, 5, pp. 428–430, 1 fig., 1942.

Out of 3,887 Kwanzan flowering cherries (*Prunus serrulata*) in a nursery planting in Oregon, 592 were observed in 1939 to be stunted, producing few lateral branches, the bark being of a deep brown colour and roughened by longitudinal splitting, while the leaves were clustered together owing to internodal shortening and mostly arched downwards through faulty development of the midribs. Two larger trees were similarly affected, the splitting and rugosity of the bark, however, being more pronounced than in the young ones. In experiments to determine the transmissibility of the disease, one lot of 25 mazzard [*P. cerasus*] seedlings was budded with buds from a normal Kwanzan tree, another with those from a rough-bark tree, and a third with buds from both the healthy and affected trees. At the age of two years, the stocks on which normal buds were grafted produced 22 well-developed trees, those budded from the diseased Kwanzan yielded only six, all dwarfed and showing typical rough-bark symptoms, while of the trees grafted with healthy and diseased buds, both developed on seven, only the normal on nine, and only the diseased on three, all the growth

resulting from these unions being characteristically affected. The production of nine rough-bark trees by the normal bud, whilst the diseased bud did not develop, indicates that the virus was transmitted even without organic union being effected, and this was confirmed on subsequent tests. Apparently normal shoots have developed in many instances from the roots of diseased mazzard trees, suggesting that this host may become a symptomless carrier of the infective principle, presumably a virus, for which the name of *Prunus* virus 9 (or alternatively, *Rimocortius kwanzani*) is proposed.

THIRUMALACHAR (M. J.). **Phragmotelium mysorensis, a new rust on Indian Raspberry.**—*Proc. Indian Acad. Sci.*, Sect. B, xv, 4, pp. 186–193, 17 figs., 1942.

In addition to *Phragmotelium formosanum* (Hirats.) comb. nov., *P. okianum* (Hara) comb. nov., and *P. rubi-fraxinifolii* (Syd.) comb. nov. (transferred from *Phragmidium formosanum* [*R.A.M.*, xiv, p. 654], *P. okianum*, and *P. rubi-fraxinifolii* (*Ann. mycol., Berl.*, xix, pp. 161–175, 1921), respectively), another species of *Phragmotelium* has recently been detected on the leaves of *Rubus lasiocarpus* in the Nandi Hills, Mysore, and is here fully described as *P. mysorensis* Thirumalachar & Mundkur n.sp. The rust is confined to the foliage, on which it produces extensive blotches. Uredo- and teleutosori develop in August and September, and pycnidia and aecidia during October and November.

CANDIOLI (P.). **Contributo alla conoscenza della causa della mortalità del Ciliego.** [A contribution to the knowledge of the cause of Cherry mortality.]—*Ital. agric.*, lxxix, 4, pp. 207–214, 7 figs., 1942.

An important cause of the dying-off of sweet cherries in the Verona district of Italy was found to be the physiological disequilibrium resulting from the use of an incompatible stock, *Prunus mahaleb*, of which the *cupaniana* variety is the least well adapted for the purpose in view, *typica* being more suitable and *transilvanica* intermediate in this respect. The lack of harmony between stock and scion (Durona di Verona) is manifested by severe constriction below the site of grafting and hypertrophy above it.

DEMAREE (J. B.). **Diseases of Strawberries.**—*Fmrs' Bull. U.S. Dep. Agric.* 1891, 27 pp., 11 figs., 1942.

This bulletin, superseding No. 1458 in the same series, contains all the necessary information for the recognition and control of the following diseases affecting strawberries in the United States: leaf spot, scorch, and blight (*Mycosphaerella fragariae*, *Diplocarpon earliana*, and *Dendrophoma obscurans*, respectively); crinkle, xanthosis, and June yellows (non-infectious leaf variegation); red stele (*Phytophthora fragariae*), apparently limited to the northern strawberry regions by the high summer temperatures of the south; black seed (a minor manifestation of *M. fragariae*, chiefly affecting the Blakemore and Pathfinder varieties and characterized by black spots, $\frac{1}{4}$ in. in diameter, round the seeds and superficial discoloration of the underlying pulp); grey, tan, hard, and leather rots (*Botrytis* sp., *Pezizella lythri*, *Rhizoctonia* sp., and *Phytophthora cactorum*, respectively), all occurring both in the field and in transit; and leak (*Rhizopus nigricans*).

TRAUB (H. P.), ROBINSON (T. R.), & STEVENS (H. E.). **Papaya production in the United States.**—*Circ. U.S. Dep. Agric.* 633, 36 pp., 8 figs., 1942.

This circular contains brief notes (pp. 30–32), based on the investigations of H. E. Stevens, on the symptoms and control of papaw leaf blight (*Asperisporium caricae*), powdery mildew (*Oidium* [*caricae*]), fruit rot (*Colletotrichum* [?*gloeosporioides*]), and damping-off (*Rhizoctonia*) [*R.A.M.*, xx, p. 26].

GOLDSWORTHY (MARION C.), GREEN (E. L.), & HALLER (H. L.). **Fungicidal properties of 2, 4-diaminodiphenylamine and other substituted diphenylamines.**—*J. agric. Res.*, lxiv, 11, pp. 667–678, 1942.

The toxicity of a new fungicide, 2,4-diaminodiphenylamine [U.S. Patent No.

2,203,431] was tested on cultures of the peach brown rot organism *Sclerotinia fructicola* and the apple bitter rot organism *Glomerella cingulata*; and in limited field spraying tests during 1939 and 1940 on apples against *Venturia inaequalis* and russet; on cherries against *Coccomyces hiemalis*; and on peaches against *S. fructicola* and *Cladosporium carpophilum*. Also, Red Kidney beans (*Phaseolus vulgaris*) and small limbs of pear, plum, apricot, and quince were sprayed to test their tolerance. In laboratory studies the new fungicide proved to be comparable in toxicity to Bordeaux mixture, and in field tests it compared favourably with standard treatments on all hosts except cherry, where it was not a sufficient protectant over a long period. The material did not injure any of the plants tested. The new fungicide is basic in character and is compatible with lime, bentonite plus lime, lead arsenate, and mineral oil, but not with bentonite alone or flocculated with nicotine sulphate; it is difficult to wet in water, but is readily dispersed by the addition of a small amount of a wetting agent.

Of a series of closely related diphenylamines tested, diphenylamine and 2′,4′-diamino-2-phenyldiphenylamine approached 2,4-diaminodiphenylamine in toxicity; 4-nitrodiphenylamine, 4-chlorodiphenylamine, and diphenylparaphenylene diamine were toxic to the conidia of *S. fructicola* but not to those of *G. cingulata*. None of the compounds except diphenylamine and 2′,4′-diamino-2-phenyldiphenylamine were injurious to Red Kidney beans.

Brown (J. H.). **A fungus culture slide.**—*Bull. Johns Hopkins Hosp.*, lxx, 5, pp. 460–462, 6 figs., 1942.

The following method has been devised for studying the development of a fungus, e.g., *Monilia* sp. and *Aspergillus niger*, from a single spore or mycelial fragment. The centre of a glass slide, 76 by 28 by 2 mm., is occupied by a polished, slightly depressed, concave table, 1 cm. in diameter, surrounded by two concentric moats connected by a short communicating moat, the outer one being similarly connected on the opposite side with the edge of the slide, which serves as an air inlet. Minute droplets of mineral oil are placed at six points on the slide—one at each side of the top and bottom of the outer moat and one at each side of the inner moat—and a full, large (4 mm.) loop of the inoculated medium (Sabouraud's agar) placed at the top of the central table. The preparation is then covered with a square 25 mm. cover-glass, below which the medium diffuses in the form of a circle broken by a notch, cut in the edge of the table on the same side as the air inlet. Contamination and desiccation of the medium are obviated by the restriction of air to that entering through the moats and the notch, while a humid atmosphere may be further promoted by incubation in a Petri dish containing a piece of moist filter paper.

Rahman (K. A.). **Legislation against plant pests and diseases.**—*Indian Fmg*, 111, 5, pp. 269–272, 1942.

This is a general survey of the present status and functions of legislation against plant pests and diseases, with special reference to Indian needs and conditions. The first line of defence in the (Indian) Destructive Insects and Pests Act, No. II of 3rd February, 1914, aims at the exclusion from the country of foreign pathogens, and the second at the eradication and control of such as have already gained entry, as well as of indigenous parasites. So far, only one out of eleven provinces and four out of 700 States have adopted the system of compulsory control: in Madras, however, where bud rot of Palmyra palm (*Phytophthora palmivora*) and sandal spike have already been extensively combated, the inhabitants are so convinced of the utility of legal measures that a petition has been submitted to the Governor-General for the obligatory extermination of cardamom mosaic. In the writer's opinion, the adoption of fixed standards of purity for plant protectives, similar to those obtaining in the United States since 1911, is highly desirable for India.

IMPERIAL MYCOLOGICAL INSTITUTE



# REVIEW OF APPLIED MYCOLOGY

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MOORE (W. C.). **Presidential address. Organization for plant pathology in England and Wales—retrospect and prospect.**—*Trans. Brit. mycol. Soc.*, xxv, 3, pp. 229–245, 1942.

After briefly reviewing the history of the organization of research on plant diseases in England and Wales from the end of the last century until about 1923, the author describes the phytopathological service as it exists to-day and discusses a number of ways in which he considers its efficiency might be still further increased.

RADEMACHER (B.). **Gedanken über Nachkriegsaufgaben im Pflanzenschutz.** [Reflections on post-war aims in plant protection.]—*Z. PflKrankh.*, lii, 2–4, p. 51–56, 1942.

Among the many pressing enterprises to be undertaken by German phytopathologists on the conclusion of hostilities may be mentioned the extension and simplification of research, in which connexion stress is laid on the urgent need for the translation of foreign (especially Russian) scientific treatises, and for a reform of the present abstracting system, so that German workers may no longer depend exclusively for their knowledge of the relevant literature on the English abstracting journals; the introduction of special phytopathological courses into the college curriculum to form a basis for subsequent practical training; and the continuation of studies already in progress on the commercial control of various pests and diseases.

TAKAHASHI (W. N.). **A virus inactivator from yeast.**—*Science*, N.S., xcv, 2475, pp. 586–587, 1942.

The author has extracted a virus inactivator from yeast by the following method. One kg. frozen baker's or brewer's yeast is mixed with 4 l. distilled water and autoclaved for 30 mins. at 15 lb. pressure. The autoclaved material is filtered through a pad of celite No. 505, and the filtrate treated with two volumes of acetone or alcohol. The precipitate is separated from the liquid by centrifuging, and is dissolved in a volume of distilled water equal to that of the original filtrate. Precipitation and solution in water may be repeated several times, but an electrolyte must be added to effect complete precipitation. This partially purified substance was used in preliminary work, but later the inactivator was further purified by clearing with safranin and neutral lead acetate, followed by heating in twice normal hydrochloric acid.

Changes in the concentration of tobacco mosaic virus induced by the inactivator were measured by inoculating half leaves of *Nicotiana glutinosa*, one half of each of 20 leaves being inoculated with each treated sample and the other halves with corresponding controls. In one typical experiment, treatment with 0·303, 0·625, 1·25, 2·5, and 5 mgm. inactivator per 100 c.c. of a suspension containing 5 mg. virus gave, respectively, 32·3, 14·8, 10·05, 3·14, and 1·42 per cent. of virus remaining active. Thus, with each doubling of inactivator concentration roughly a halving of active virus concentration occurred. This suggests a chemical reaction between one unit of inactivator and one unit of virus. The virus-inactivator combination was broken when the mixture was heated to 99° C. for 10 minutes.

When rose, peach, and pear scions from virus-infected parents were placed in a solution of the inactivator for several days and grafted to healthy stocks, typical symptoms of each disease resulted. In further experiments with leaves no conclusive evidence was obtained that the inactivator destroyed the virus. The substance in question appears to be a polysaccharide.

RESÜHR (B.). **Zur Chemie der Symptombildung viruskranker Pflanzen.** [On the chemistry of symptom production in virus-diseased plants.]—*Z. PflKrankh.*, lii, 2–4, pp. 63–83, 15 figs., 1942.

With a view to determining the possible rôle of substances, other than the viruses concerned, in the production of symptoms in virus-diseased plants, the author carried out a series of experiments at the Bonn Phytopathological Institute involving the injection into various plants of 55 organic compounds and a series of crude tannins.

The introduction of a 2 to 4 per cent. solution of hydrolysable or condensed tannin into the shoot axis in doses of 0·05 to 0·1 c.c. resulted in vein-clearing, vein-banding, loss of chlorophyll, asymmetry, vein-browning, mosaic and local necrosis, stunting, crinkle, undulation (notably of bean [*Phaseolus vulgaris*] leaves), leaf roll (of broad bean), thickening and shortening of the shoot axis, e.g., of tomato and soy-bean, and breaking of tulip flowers. Anthocyanin formation, one of the symptoms of big bud [*R.A.M.*, xx, pp. 182, 235], occurred in the treated tomato leaves. Contrary to Schweizer's observations, in connexion with a study of potato leaf roll, as to the accumulation of starch in the foliage into which tannin was injected [ibid., x, p. 333], starch production in the leaves of *Nicotiana glutinosa* in the writer's tests was lowered by the treatment. In general, the injection of the hydrolysable gallic acid esters induced much more acute symptoms than those resulting from catechin tannins, except at high concentrations. However, the pathological effects on the plants of these two structurally divergent groups were of the same order, whereas those due to haematoxylin, a relative of the catechins, were quite dissimilar. Gallic acid itself was the only phenolic non-tannin to exert a similar action to the tannins, especially as regards vein-clearing. All the other phenol compounds, in so far as they diffused into the leaf blade at all (some destroyed the tissues immediately on contact), provoked severe, sometimes local, interveinal necrosis, e.g. resorcin and orcin on *N. glutinosa* and peas, ill-defined chloroses of the tissues adjoining the main veins, extensive discoloration and death of the leaf blade, mild crinkle and undulation (pyrogallol and pyrocatechin on tobacco, for instance), or foliar malformations (protocatechualdehyde on *N. glutinosa*).

Analyses of the leaves and shoot axes of cauliflower, Chinese cabbage, rape, *Tulipa gesneriana*, tobacco, potato, and *Abutilon* plants spontaneously infected by viruses revealed a tannin content exceeding by 0·1 to 0·8 times and upwards (calculated on a dry-weight basis) that of the corresponding portions of healthy individuals. In the case of plants receiving artificial injections of tannins the increase in the contents of such substances amounted at the most to 1·3 or 1·4 times the normal.

As with natural virus infection, the injected tannins require a minimum incubation period of some days at 15° to 20° C. to produce their symptoms, which may, again like the milder forms of spontaneous attack, be reversible. Another feature in which the effects of tannin injections resemble those of virus diseases are the asymmetrical patterns arising from the diffusion of the extraneous substance through the leaf, sometimes at a considerable distance from the site of inoculation. Like the viruses, moreover, the tannins induced much weaker symptoms, e.g., on tobacco, *N. glutinosa*, peas, and rape, at 30° than at an average temperature of 15° to 20°.

From the results of these experiments, supplemented by a study of the relevant literature, the author concludes that many of the pathological effects of viruses are bound up with disturbances of the phenol, and more particularly of the tannin, metabolism of the host.

Lindegren (C. C.) & Lindegren (Gertrude). **X-ray and ultra-violet induced mutations in Neurospora. II. Ultra-violet mutations.**—*J. Hered.*, xxxii, 12, pp. 435–440, 1 fig., 1941.

The writers have continued their studies at the University of Southern California, Los Angeles, on the inducement of mutations in *Neurospora crassa* [*R.A.M.*, xxi, p. 154] by irradiation with ultra-violet light with a wave-length of 2537 Å from a mercury vapour tube situated 21 cm. from the surface of the nutrient agar cultures and delivering 900 ergs per sq. mm. per minute. Under 1 per cent. of the spores withstood the treatment, and some 9 per cent. of the surviving individuals gave rise to mutants, nearly half of which were degenerate phenotypes not susceptible of genetical analysis, though one (U-8, burnt-fluffy type of colony) made exceptionally vigorous growth and sporulated profusely on potato dextrose agar; this is the first progressive mutant hitherto detected in *N. crassa*. None of the ultra-violet mutants displayed the diminished fertility characteristic of chromosome inversion.

In the first series of X-ray experiments, some 50 per cent. of the spermatia survived, and of these about a quarter yielded mutants.

Jameson (Dorothy H.) & Schmidt (Catherine M.). **Boron as a plant nutrient. A bibliography of literature published and reviewed, January 1939, through December 1939. (With index). Supplement II.**—xviii+81 pp., American Potash Institute, Inc., Washington, D.C., 1940. [Mimeographed].

Schmidt (Catherine M.) & Jameson (Dorothy H.). **Boron as a plant nutrient. A bibliography of literature published and reviewed, January, 1940, through December, 1940. (With index). Supplement III.**—xvi+68 pp., American Potash Institute, Inc., Washington, D.C., 1941. [Mimeographed.]

These supplements continue the annotated bibliography of boron as a plant nutrient published by the American Potash Institute [cf. *R.A.M.*, xviii, p. 702]. Together they contain 700 items.

Van der Merwe (D. J.). **The occurrence, characteristics and function of manganese in soil and plant.**—*Fmg S. Afr.*, xvii, 195, pp. 360–364, 1942.

On the Cape Flats, western Cape Province, South Africa, where there is general manganese deficiency in the soil, bean [?*Phaseolus vulgaris*] plants were effectively treated by spraying with a $\frac{1}{4}$ per cent. potassium permanganate solution, and maize, tomato, potato, and pea plants by spraying with a $\frac{1}{4}$ to $\frac{1}{2}$ per cent. manganese sulphate solution.

In Somerset West, vines affected by manganese deficiency showed interveinal chlorosis and gave a poor yield. The affected leaves had a manganese content of 32 parts per million, as against 360 to 413 p.p.m. for healthy vine leaves elsewhere.

In the same locality, a manganese deficiency was determined in potatoes and green beans, and was overcome by applications of manganese sulphate to the soil. Peach trees in this area reacted to spraying with a $\frac{1}{2}$ per cent. manganese sulphate solution, and pear and citrus to one of 1 per cent.

At Stellenbosch and Brakenfel citrus, peach, bean, nectarines, and plums were successfully sprayed with one or other of the following: $\frac{1}{4}$ per cent. potassium permanganate, 1 per cent. manganese sulphate + $\frac{1}{2}$ per cent. calcium hydroxide, and $\frac{1}{4}$ per cent. manganese sulphate.

At Constantia, manganese deficiency affected grape vine, granadilla, apricot, and chestnut trees. At Biene Bonne affected citrus trees were successfully sprayed with 1 per cent. manganese sulphate solution. Peaches were also affected at Elgin, and showed a general interveinal chlorosis accompanied by poor yields. The condition responded to injection with manganese solutions.

Wallace (T.) & Ogilvie (L.). **Manganese deficiency of agricultural and horticultural crops. Summary of investigations, season 1941.**—*Rep. agric. hort. Res. Sta. Bristol, 1941*, pp. 45–48, [1942].

Further investigations on manganese deficiency of crops in the vicinity of Long Ashton [*R.A.M.*, xx, p. 439] confirmed the outstanding susceptibility of oats, but also showed that wheat may be severely affected on certain silt clay soils.

Experiments on Globe beetroots showed that manganese sulphate and manganese chloride used as fertilizers at rates equivalent to 100 lb. manganese sulphate per acre effectively overcame the deficiency only during the earlier stages of growth; manganese ores used at a similar rate were ineffective at all stages. Used as sprays at rates between 5 and 40 lb. per acre on plants half-grown or in the later stages of growth, manganese sulphate and manganese chloride were very effective, the former rate being adequate for commercial purposes.

Robbins (W. J.) & Kavanagh (Virgene). **Vitamin deficiencies of the filamentous fungi.**—*Bot. Rev.*, viii, 7, pp. 411–471, 1942.

Preceding a list of filamentous fungi (arranged in alphabetical order) and their vitamin requirements is a brief critical survey and discussion of the general principles, exemplified by concrete illustrations, underlying the utilization by this group of organisms of the accessory growth substances (a term defined as embracing a wider scope than vitamins). Among the aspects of the problem investigated are the capacity of the individual fungi for vitamin synthesis, the functions and specificity of the several vitamins, the requisite amounts of auxins for the promotion of growth, and the methods of investigation employed in the determination of fungal needs in this direction. References to a number of the papers in the seven-page bibliography have already appeared in this *Review*.

Thatcher (F. S.). **Further studies of osmotic and permeability relations in parasitism.**—*Canad. J. Res.*, Sect. C, xx, 5, pp. 283–311, 2 pl., 9 graphs, 1942.

Continuing his earlier studies on changes in host cell permeability induced by fungal parasitism [*R.A.M.*, xviii, p. 812], the author found that *Puccinia graminis* race 21 increased permeability in the cells of the susceptible Mindum and Little Club wheat varieties. The resistance of Mindum to race 36 of *P. graminis* was associated with a local decrease of cell permeability. Narcotization of Mindum wheat increased permeability and rendered it more susceptible to race 36.

Increase of permeability resulted from tissue invasion by *Botrytis cinerea* and *Sclerotinia sclerotiorum* on the petioles of mature celery plants and by *Phytophthora infestans* on potato petioles.

Decreased permeability of the tissues of swede 'root' near the margin of a necrotic lesion due to *Phoma lingam* was interpreted as a change in accordance with Brown's suggestion [ibid., xiv, p. 189] that a dry rot is determined by the ability of the host to restrict the amount of water reaching the fungus and so arrest the progress of its enzymic activity at an intermediate stage.

Steinberg (R. A.) & Thom (C.). **Reversion in morphology of nitrite-induced 'mutants' of Aspergilli grown on amino acids.**—*J. agric. Res.*, lxiv, 11, pp. 645–652, 1942.

In further studies on chemically induced variants or mutants of *Aspergillus* spp. [*R.A.M.*, xix, p. 722], a nitrite-induced mutant of *A. niger* was observed to revert to the morphology of the original strain when grown on lysine, cystine, $\beta$-phenyl-$\beta$-alanine, threonine, and valine. The best results were obtained on a mixture of nicotinic acid, lysine, and valine. Complete reversion of a nitrite-induced variant of *A. amstelodami* took place only with a mixture of lysine and threonine. The ability to assimilate amino acids did not appear to play a major part in these responses. The respective

capacities for amino acid utilization in the standard strain and each of two variant strains of *A. niger* varied proportionally to the extent of morphological change.

KÖHLER (E.) & BÄRNER (J.). **Über den sogenannten latenten Virusbefall in deutschen Kartoffelsorten.** [On the so-called latent virus infection in German Potato varieties.]—*Forschungsdienst*, xiii, 1, pp. 14–18, 1942.

During 1938–9 greenhouse tests were conducted at the Biological Institute, Dahlem, Berlin, to determine the extent of latent virus infection in 68 officially recognized German potato varieties, with a view to the ultimate exclusion from cultivation of any carrying disease in a masked form. The presence of concealed infection was established by the development of the typical symptoms in slips, supplemented by transmission to tobacco where indicated. Eleven varieties of externally healthy aspect were found to be harbouring viruses, viz., X in Erstling [Duke of York], Early Rose, Direktor Johanssen, Jubel, and Wart-Immune Kaiserkrone, A in Allerfrüheste Gelbe and Paulsen's Juli, and Y in Frühe Hörnchen, Rote Mäuse, and Tannenzapfen; out of 149 Preussen tubers, 28 yielded A, 116 X, one both, and four neither. All these varieties have been on the market for considerable periods, even the most recent, Allerfrüheste Gelbe, since 1922.

Of the viruses represented, X is chiefly injurious to the varieties actually carrying this source of infection, whereas A and Y are readily communicable by *Myzus persicae* to adjacent plantings. Serious damage is also likely to ensue when plants already harbouring X contract fresh infection by A or Y, the mixture exerting a peculiarly virulent influence. The X virus is easily transmissible in the field from diseased to healthy plants by means of the sap, e.g., through foliar contact and agricultural implements. Such sources of contagion, however, can be avoided by the exercise of reasonable care, whereas the elimination of A and Y demands special precautions, notably in districts where peaches are grown in proximity to potatoes, i.e., virtually throughout Germany [*R.A.M.*, xx, p. 487]. In such regions Juli, Allerfrüheste Gelbe, Frühe Hörnchen, Rote Mäuse, and Tannenzapfen should be grown in specially selected sites remote from other potato plantings, particularly those destined for seed. Where this is impracticable, growers would be well advised to relinquish the use of these varieties altogether.

SKAPTASON (J. B.) & BURKHOLDER (W. H.). **Classification and nomenclature of the pathogen causing bacterial ring rot of Potatoes.**—*Phytopathology*, xxxii, 5, pp. 439–441, 1942.

The reasons adduced for the authors' acceptance of the name *Corynebacterium sepedonicum* for the agent of bacterial ring rot of potatoes [*R.A.M.*, xxi, p. 364] are briefly discussed in relation to the existing confusion in its classification. Thorough studies of the morphology and physiology of the pathogen have shown it to possess all the features of a *Corynebacterium*, including (1) pleomorphism, with the formation of large numbers of clavate cells, (2) non-motility, (3) V- or L-shaped cells indicating 'snapping division', (4) staining and acid reactions, (5) almost exclusive single occurrence of the cells, (6) demand for a complex medium containing an abundance of proteins, (7) strictly aerobic growth, (8) general biochemical inactivity, and (9) very slow rate of development on standard media. The organism should in future be known as *C. sepedonicum* (Spieckermann & Kotthoff) comb. nov. [presumably antedating Dowson's combination: loc. cit.]. Spieckermann and Kotthoff are regarded as the correct authorities for the original species, the name published by Spieckermann in 1913 being a *nomen nudum*.

SCHROEDER (R. A.) & ALBRECHT (W. A.). **Plant nutrition and the hydrogen ion: II. Potato scab.**—*Soil Sci.*, liii, 6, pp. 481–488, 4 figs., 1942.

The results, in terms of potato tuber and top yields and of scab [*Actinomyces scabies*]

incidence, in tests at the Missouri Agricultural Experiment Station in which the levels of exchangeable calcium and potassium were varied in relation to each other while other nutrients were held constant, all at different degrees of soil acidity, point to the importance of the ratio of calcium to potassium in the production of the crop. Contrary to the common belief in the tendency of liming to provoke scab, a liberal supply of calcium was found to assist the movement of potassium into the tops, the highest yields, coupled with freedom from disease, being obtained by the addition to the soil of approximately equal amounts of the two fertilizers. An excess of potassium over calcium was more conducive to scab than when these ratios were reversed. Thus, the relationship of calcium to potassium is synergistic rather than antagonistic. The observed efficacy of soil acidity as a means of controlling *A. scabies* is apparently based on the mobilization of certain cationic plant nutrients under these conditions.

MARSH (R. W.) & MARTIN (H.). **Simplified methods of Potato blight control. Progress report III.**—*Rep. agric. hort. Res. Sta. Bristol, 1941,* pp. 79–82, [1942].

In further experiments on the control of potato blight [*Phytophthora infestans*: *R.A.M.*, xx, p. 416] in three localities, using Majestic and Arran Banner potatoes, the proprietary copper fungicides coppesan, perenox, and soltosan gave equally satisfactory results, and sprinkling from a watering can retarded spread as effectively as did spraying.

MUJICA (R. F.). **Nomina de las enfermedades y pestes de la Papa cuya existencia se ha comprobado en el país.** [List of Potato diseases and pests of which the existence has been established in the country.]—*Bol. Sanid. veg., Santiago*, i, 1, pp. 70–72, 1941.

The following potato diseases are known to occur in Chile: latent [potato virus X], mild, (*Marmor solani* H.), and rugose mosaics, leaf roll (*Corium solani* H.), spindle tuber (*Acrogenus solani* H.), aucuba mosaic (*M. aucuba* H.), scab (*Actinomyces scabies*), early blight (*Alternaria solani*), rhizoctoniosis (*Botryobasidium* [*Corticium*] *solani*), powdery scab (*Spongospora subterranea*), wilt (*Verticillium albo-atrum*), sclerotiniosis (*Sclerotinia sclerotiorum*), blackleg (*Bacillus phytophthorus* [*Erwinia phytophthora*] and related species), bacterial rot, probably due to *E. carotovora* and allied species (the three last-named diagnosed on a symptomatological basis only), and (?) silver scurf (*Spondylocladium atrovirens*).

**Labor de la sección investigaciones y certificación de Papas en el primer semestre de 1941.** [Work of the division of investigations and certification of Potatoes during the first six months of 1941.]—*Bol. Sanid. veg., Santiago*, i, 1, pp. 73–74, 1941.

In an experiment on the transmission of potato spindle tuber by way of the tubers [cf. *R.A.M.*, xi, p. 667; xv, p. 776], a much higher proportion of diseased plants arose from the misshapen tubers than from the healthy controls, and this result emphasizes the need for the exclusion of affected tubers from stocks destined for seed.

Circumstantial evidence having suggested the passage of *Spongospora subterranea* through the intestinal tract of livestock in a viable state, leading to fresh outbreaks of powdery scab on potatoes in virgin soils, experiments were conducted to ascertain the value of cooking the infected refuse before its consumption as fodder. This practice, combined with the use of healthy tubers for seed, resulted in complete freedom from the disease.

VERNER (A.), MALYSHKIN (P.), & KVINT (N.). **Development of fungi in the soil.**—*C. R. Acad. Sci. U.R.S.S.*, N.S., xxxi, 8, pp. 812–814, 1941.

The plating and the Cholodny slide techniques were both used with comparable results for the determination of the survival of certain fungi in the soil. *Fusarium lini*, inoculated into sterile and normal soils, was found to increase steadily in the former

(declining only after a certain maximum had been reached, this decline possibly being due to lysis), and to decrease and finally disappear altogether in the latter. It is concluded that the survival of fungi in soil is conditioned by the presence of antagonistic micro-organisms. To check this assumption, a small amount of normal soil was introduced into sterilized soil ten days after inoculation with *Verticillium dahliae*. It appeared that the growth of the fungus in this series was increasing before the normal soil was added, but after the addition it declined and finally stopped altogether, while the number of protozoa increased and that of bacteria fluctuated; in a parallel normal soil series the development was roughly the same as in the first after the addition of normal soil; in a third sterile soil series the initial increase in fungal growth was again followed by a decline. Saprophytic fungi were found capable of a better survival in soil and even of multiplication in it. Thus, 25 days after inoculation, *Trichoderma lignorum* [*T. viride*: *R.A.M.*, xx, p. 491; xxi, p. 220] had increased to 1,910,000 from 48,000 in the normal soil and to 3,650,000 from 93,000 in sterile; *Aspergillus* sp. had decreased to 100,000 from 138,000 in the normal soil, and increased to 138,000 from 128,000 in the sterile.

BRANDENBURG (E.). **Versuche über Bormangel an Mohn.** [Experiments on boron deficiency in the Poppy.]—*Z. PflKrankh.*, lii, 2–4, pp. 56–63, 5 figs., 1942.

Bertrand and de Waal have shown the poppy [*Papaver officinale*] to be one of the plants with the highest boron content, amounting to 94·7 mg. (579·8 mg. boric acid) per kg. dry weight [*R.A.M.*, xvi, p. 81], compared with which the quantity of boric acid in sugar beets on natural soils is relatively low (average of 250, occasionally up to 320 mg.) [ibid., xviii, p. 428]. In co-operative experiments at the Bonn and Vienna phytopathological stations, Mahndorf Blue poppies, both on soils naturally lacking in boron and in sand-peat cultures from which this element was partially or wholly withheld, developed boron deficiency symptoms corresponding in the main with those of other dicotyledonous plants under similar conditions and consisting of floral and capsule malformations and seed necrosis, and in severe cases of the cessation of growth at an early stage. The boric acid contents of plants in sand-peat cultures receiving 0, 10, and 20 mg. per pot (each containing eight plants and 10 kg. soil) was 124, 177, and 214 mg. per kg. dry weight, respectively, while the contents of those on natural soils given 0, 15, and 30 mg. per pot were 111, 139, and 199 mg., respectively. In a further test with plants in sand-peat cultures (3 l. pots, three plants in each), the boron-deficient plants ceased to grow at a height of 10 to 15 cm. and their fresh weight at harvest amounted to 110·6 gm., corresponding to a boric acid content of 118 mg. per kg. dry substance, while the fresh weights and boric acid contents of the plants receiving 10 and 20 mg. boric acid per pot were 252·9 gm. and 283 mg. and 377·6 gm. and 416 mg., respectively.

RAMAKRISHNAN (T. S.). **A leaf spot disease of Zingiber officinale caused by Phyllosticta zingiberi n.sp.**—*Proc. Indian Acad. Sci.*, Sect. B, xv, 4, pp. 167–171, 1 pl., 1942.

Since 1938, ginger in the Godavari and Malabar districts of Madras has been affected during the late summer and early autumn by a disease involving the formation on the leaves of spots with white centres, dark brown margins, and yellowish surrounding haloes, some circular, 1 by 0·5 mm., and others oval or elongated, 9 to 10 by 3 to 4 mm., usually isolated but occasionally confluent, causing extensive discoloration and desiccation. The causal organism, *Phyllosticta zingiberi* n.sp., is characterized by amphigenous, subglobose, dark brown, ostiolate pycnidia, 78 to 150 $\mu$ in diameter on the host, 100 to 270 (mean 177·6) $\mu$ on standard media, and hyaline, unicellular, oblong, biguttulate spores, 3·7 to 7·4 by 1·2 to 2·5 (4·3 by 1·6) $\mu$. The optimum hydrogen-ion concentration for the growth of the pathogen on Richards's agar lies between $P_H$ 4·3 and 5·8. Wound inoculations gave positive results on ginger and turmeric (*Curcuma longa*). The disease under observation, though not at present serious, may

lead to a heavy reduction in rhizome yield through the extensive destruction of chlorophyllous tissue. Good control has been secured by one or two applications of 1 per cent. Bordeaux mixture.

Padmanabhan (S. Y.) & Rafay (S. A.). **Two new reports of fungi on Saccharum officinarum and S. arundinaceum.**—*Curr. Sci.*, xi, 4, pp. 150–152, 2 figs., 1942.

Characteristic fructifications of *Schizophyllum commune* were observed at the Central Sugar-Cane Research Station, Pusa, in November, 1941, on stalks of Co. 331 sugar-cane killed by 'red rot' [*Colletotrichum falcatum*: *R.A.M.*, xx, p. 228], while similar fructifications were observed a week later on Co. 331 artificially infected with red rot, and on affected Co. 331 canes brought from Motipur. Experimental infections of growing stalks of Co. 331 with pieces of the ripe fructifications and spore suspensions of *S. commune* indicated that the fungus has weakly parasitic tendencies on sugar-cane. That the occurrences were observed on Co. 331 alone, however, indicates selectivity by the fungus.

During August, 1940, uredosori of *Puccinia kuehnii* on previously rust-free clumps of *Saccharum arundinaceum* were found to be parasitized by *Darluca filum* [ibid., xx, p. 570].

Sparrow (F. K.). **Phycomycetes recovered from soil samples collected by W. R. Taylor on the Allan Hancock 1939 expedition.**—*Publ. Univ. sth. Calif. A. Hancock Pacif. Exped.*, iii, 6, pp. 101–112, 2 pl., 1940. [Received August, 1942.]

This is a critically annotated list of six Phycomycetes isolated from soil samples in Central and South America in 1939.

Willis (J. H.). **Victorian fungi.**—72 pp., 16 pl. (3 col.), 18 figs., Melbourne, Field Naturalists' Club of Victoria, 1941. 2s. 6d.

This illustrated booklet, to which a foreword is contributed by Ethel I. McLennan, comprises semi-popular notes on the fungus flora of Victoria, the species described numbering 120 Agaricaceae, while brief references are made to Victorian Polypores, Clavariaceae, Gasteromycetes, and five species of *Cordyceps* (*C. gunnii*, *C. menesteridis*, *C. taylori*, *C. militaris*, and *C. hawkesii*).

Terrier (C. A.). **Essai sur la systématique des Phacidiaceae (Fr.) sensu Nannfeldt (1932).** [An exposition on the taxonomy of the Phacidiaceae (Fr). *sensu* Nannfeldt (1932).]—Thesis, École polytechnique fédérale de Zürich, 99 pp,. 12 pl., 2 figs., 1 diag., 9 graphs, 1942.

The numerous modifications undergone by the family of the Phacidiaceae between its erection by Fries in 1821 and Nannfeldt's revision in 1932 [*R.A.M.*, xi, p. 606] suggested the desirability of an intensive study of the taxonomy of the group, to which the present work is a preliminary contribution. The first chapter deals with the history of the Phacidiaceae, the second with the morphology of the form-types of genera constituting the family, while the third defines the basic principles of a natural system of classification. The outstanding conclusion of the author's researches is that the family is heterogeneous, comprising both ascohymenial and ascolocular forms, of which the former belong in part to the Hypodermataceae and the rest to the Rhytismaceae and are placed in a new order, the Hypodermatales, while the latter are the representatives of the Phacidiaceae *sensu stricto*. The peculiarities of the lenticular fructifications of the Hypodermataceae and Rhytismaceae reveal their affinity with the Drepanopezizoideae Nannf. and the ascolocular structure of the Phacidiaceae relates them to the Dothioraceae.

Hills (C. H.) & McKinney (H. H.). **A chemical method for the determination of Tobacco-mosaic-virus protein in plant extracts.**—*Phytopathology*, xxxii, 5, pp. 433–435, 1942.

The probability of a considerable margin of error in the results obtained by the method of L. F. Martin *et al.* for the measurement of virus protein in tobacco leaf tissue [*R.A.M.*, xix, p. 168] led to further studies on this problem, the technique finally adopted for the separation of virus from non-virus proteins in foliar extracts being based on Best's observation that the mosaic virus is precipitated from aqueous solutions at its isoelectric point, $P_H$ 3·4 [ibid., xv, p. 531]. An extract of mosaic-diseased tissue was prepared by adding 1 c.c. of M/10 phosphate buffer per gm. of chopped frozen tissue and after thawing the tissue extract was clarified by centrifuging or filtering through celite. A 40 c.c. portion of the clear extract was acidified to $P_H$ 4·2 to 4·0 by N/10 sulphuric acid and a large part of the non-virus protein precipitated during overnight refrigeration removed by centrifuging at 3,000 r.p.m. The supernatant liquid was decanted, acidified to $P_H$ 3·4, allowed to refrigerate overnight and then centrifuged for 30 minutes. Protein nitrogen in the precipitate was determined by precipitation with 2·5 per cent. tri-chloroacetic acid and digestion and distillation as ammonia in a micro-Kjeldahl apparatus. As the protein precipitated included a trace of non-virus protein it was necessary to run a blank on an extract of healthy leaf tissue. Comparative tests showed that the isoelectric precipitation method has a smaller experimental error than the biological assay methods. It is rapid and permits expression in absolute quantities rather than in comparative lesion counts. Biological assays, however, must be used when virus activity is in question, only small amounts of virus are available, and the virus protein concentration is very low.

Ryjkoff (V. L.) & Smirnova (Mme V. A.). **Liquid crystals of the virus of the Tobacco mosaic (Nicotiana virus 1 Allard).**—*C. R. Acad. Sci. U.R.S.S.*, N. S., xxxi, 9, pp. 930–932, 2 figs., 1941.

The formation of liquid crystals was observed in polarized light with crossed nicols under the microscope in drops of purified tobacco mosaic virus by mixing either two concentrations of this virus with one another or a solution of this virus (or *Cucumis* virus 2) with 1 to 3 per cent. solutions of starch or gelatine or with a drop of a liquid glass solution. The liquid crystals are bi-refringent, lens-shaped, varying greatly in size, the largest reaching 140 to 170 $\mu$ by 17 to 40 $\mu$.

**Sumatra fights pseudo-mosaic disease.**—*Foreign Crops Mark., U.S. Dep. Agric., 1942*, January, p. 10, 1942. [Mimeographed.]

The 1941 Sumatra tobacco crop, already reduced by a 25 per cent. curtailment of the planted area, sustained 10 per cent. damage from pseudo-mosaic [or pseudo-peh sim: *R.A.M.*, xx, p. 280], which is favoured by dry seasons. The effects of the disease were most serious on the low-lying coastal estates specializing in the sand-leaf grades sold principally in European markets, plantations situated at higher elevations and producing the good-quality foot-leaves used in the United States being less affected. One of the measures now being applied by scientists in the employ of the Deli Planters' Association is the elimination of a shrub belonging to the boneset [*Eupatorium perfoliatum*] and Joe Pye [*E. purpureum*] weed family, which is believed to harbour the white fly [*Bemisia gossypiperda*] concerned in the spread of infection and almost inaccessible to insecticides.

Yatzynina (Mme K. N.). **Breeding for Tomato variety resistant to bacterial cancer Aplanobacter michiganense E. F. Smith.**—*C. R. Acad. Sci. U. R. S. S.*, N.S., xxxii, 5, pp. 372–373, 1941.

In inoculation tests carried out during 1939 in hot beds out of doors and on a field

plot, 25 plants out of a total of 2,728 inoculated tomato hybrids from crosses between currant tomato (*Lycopersicum pimpinellifolium*) and different cultivated varieties showed signs of resistance to bacterial canker (*Aplanobacter* [*Corynebacterium*] *michiganense*) [*R.A.M.*, xxi, p. 172]. In the following year progeny of these plants were again found to be very resistant, although not immune. Among them, Lucullus × Currant (No. 1) and Danish Export × Currant (Nos. 9 and 22) showed particularly good growth: none of the three suffered any mortality and their yields were 1·8, 1·7, and 1·5 kg. per plant, respectively. Hybrids from 146 other crosses (6,500 plants tested in 1939 and 1,620 in 1940) showed no resistance to the disease. Of several *Lycopersicum* species tested, only *L. pimpinellifolium* showed a strong degree of resistance.

Young (P. A.). **Two genetic characters of Tomato fruits that might be mistaken for symptoms of disease.**—*Phytopathology*, xxxii, 5, pp. 436–438, 1 fig., 1942.

At the Tomato Disease Laboratory, Jacksonville, Texas, in 1939, two tomato fruits on a plant of the (T560) Michigan State Forcing variety were observed to bear broad, dark green stripes simulating mosaic but apparently arising from a mutation. In 1940, seed from the affected tomatoes produced 23 plants with many small, green fruits traversed from the stem- to the blossom-end of the peel by prominent, broad, dark stripes, which gradually developed into deep pits and grooves and turned yellow in contrast to the normal red portions. Seed from four of the striped fruits was tested for a third generation in the field in 1941. The parent fruits of T560B and T560D bore only stripes, and those of T560C and T560E both stripes and pits: in the field 72 per cent. of the 184 plants of T560B and T560D developed striped and pitted fruits, which also arose from 94 per cent. of the 221 plants of T560C and T560E. These data are interpreted as evidence of the hereditary character of the stripe and pit symptoms, which are distinctly different from those of tomato fruit pox or fruit stripe [*R.A.M.*, xix, pp. 499, 622].

Kearns (H. G. H.). **A method of spraying outdoor Tomatoes.**—*Rep. agric. hort. Res. Sta. Bristol, 1941*, pp. 70–71, [1942].

Outdoor tomatoes growing in England, particularly in the west, are subject to infection by *Phytophthora infestans*. The disease spreads rapidly during wet weather in late summer, and in 1941 unsprayed crops in some localities sustained very severe losses. In one experiment made in that year on 1½ acres of tomatoes, including the Market King, Plumpton King, Radio, and Potentate varieties, very satisfactory results followed a single application in early August of copper oxychloride (400 gals. per acre) though an adjacent, unsprayed crop covering an equal area suffered nearly complete loss. Details are given of the suggested lay-out of the mains over alleyways for use either for watering the crop or conveying the fungicide. The spray is applied at 350 lb. per sq. in. and a hose length of about 75 ft. is recommended.

Smucker (S. J.). **Scolytus sulcatus and Apple trees in relation to the Dutch Elm disease control program.**—*Phytopathology*, xxxii, 5, pp. 441–442, 1 fig., 1942.

The results of preliminary investigations during the last two years at Morristown, New Jersey, on the pathogenicity and longevity of *Ceratostomella ulmi* in inoculated wild apple trees [*R.A.M.*, xix, p. 680] showed that in a period of three months (from the beginning of June to early September, 1939), the minimum, maximum, and average distances of spread of the fungus were 5·25, 111·68, and 47·75 in., respectively. The organism was present in the xylem of all the 50 out of 100 inoculated trees examined and in 16 the discoloration extended into the twigs, but no external symptoms of the disease were apparent in any of the trees. On 24th September, 1939, 11 of the infected trunks, which after the first examination had been placed on the ground under dense shade, were found to bear coremia, and from 1st to 3rd October, 1940, *C. ulmi* was isolated in pure culture from the discoloured xylem of 19 out of the 50 trunks that had

been stored on the ground for 13 months. In March, 1941, only two of the trunks yielded the fungus, which must have completely died out soon afterwards, since attempts at its recovery in the following September were unsuccessful. However, samples cut from nine out of ten of the remaining inoculated trees in the same month were found to harbour *C. ulmi*.

None of the 535 maternal galleries of *Scolytus sulcatus* in 107 samples of apple wood collected in New Jersey and New York from points within a radius of 1,000 ft. of diseased elms yielded *C. ulmi* in isolation experiments by J. M. Walter's technique (*Phytopathology*, xxv, pp. 37–38, 1935), nor was the fungus obtained from 14,311 beetles collected on emergence from the infested material and placed in rearing jars. Apple wood harbouring *S. sulcatus* does not appear, therefore, to constitute an important source of inoculum of *C. ulmi*, and may for the present be disregarded in the planning of control programmes.

URQUIJO LANDALUZE (P.). **La enfermedad de la 'tinta' del Castaño y su tratamiento.** [The Chestnut ink disease and its treatment.]—*Agricultura, Madr.*, xi, 118, pp. 54–56, 6 figs., 1942.

The presence of the ink disease of chestnuts in Spain is believed to date from 1726, though the causal organism, *Phytophthora cambivora*, was only described by Petri from Italy in 1917. The life-history of the fungus is briefly summarized, and an account is given of the author's successful method of combating the disease by the treatment of the exposed roots with a copper carbonate or copper oxychloride solution, which since the opening of the campaign in 1934 has been applied to some 2,500 trees [*R.A.M.*, xxi, p. 354].

SMITH (G. E. P.). **Creosoted Tamarisk fence posts and adaptability of Tamarisk as a fine cabinet wood.**—*Tech. Bull. Ariz. agric. Exp. Sta.* 92, pp. 222–254, 10 figs., 2 diags., 1941.

This is a progress report on the condition of tamarisk (*Tamarix aphylla*) fence posts treated with creosote by various procedures at the Arizona Agricultural Experiment Station and elsewhere in the State, from which it appears that, judging by the freedom from decay of the wood after five years in the ground, a service life of at least 12 to 15 years may be anticipated.

HILBORN (M. T.). **The biology of Fomes fomentarius.**—*Bull. Me agric. Exp. Sta.* 409, pp. 161–214, 17 pl., 1 fig., 3 graphs, 1942.

*Fomes fomentarius* [*R.A.M.*, xviii, p. 214] (the synonyms of which comprise 27 binomials) has been reported from most of North America, the British Isles, northern and central Europe, China, Japan, and northern Africa on 23 genera and 56 species of trees. In New England, the fungus is mainly confined to *Betula* and *Fagus* spp., while in Maine it occurs most commonly on *B. populifolia*, *B. lutea*, *B. papyrifera*, and *F. grandifolia* in decreasing order of incidence.

Morphological examination of the sporophore showed that the tube layers are stratified. Basidia were found only in the current year's tube layers. At the end of each season the last tube layer is sealed by a sterile hyphal layer which prevents further spore discharge. In Maine, the spores from white birch measured $25{\cdot}45 \pm 0{\cdot}142$ by $7{\cdot}33 \pm 0{\cdot}025\ \mu$, and those from grey birch $22{\cdot}41 \pm 0{\cdot}106$ by $10{\cdot}34 \pm 0{\cdot}126\ \mu$.

Spore discharge persisted for approximately 180 days, falling into three phases, pre-peak, peak, and post-peak. Atmospheric humidity influenced spore discharge only in the first phase; the effect of temperature was most pronounced in the last, and during the peak period the food reserves of the sporophore apparently influenced discharge.

Twenty-eight isolates from North America and Europe were studied, but showed no evidence of the existence of strains or local races within the species. Isolates from

different hosts or localities showed more variation in growth rate caused by the medium than by the source of the isolate. The range of cultural characters did not fall outside the characters used to separate *F. fomentarius* from other species in the genus. All exhibited mutual aversion when two different isolates were plated together.

The fungus destroyed heart and sapwood at equal rates in cultures. Isolates differed in their ability to cause decay, though such differences resulted from individual variation and were not correlated with any host or locality influence. The fungus causes a white, mottled rot in the heart and sapwood of living and dead trees, principally birch, beech, and poplar. In living trees the heartwood is attacked first, but in dead ones both heart and sapwood are attacked simultaneously. Sporophores are rare on living trees in Maine, only two such being found. The fungus was present in infected wood most abundantly in the wood rays and lumina of the vessels, which were frequently completely filled with closely packed masses of hyphae.

Chemical studies demonstrated that lignin and cellulose were attacked simultaneously. No differences in the utilization of pentosans were evident, but a decrease in alkali solubility of the decayed wood characteristic of the white rots was apparent, while the losses in calorific value were proportional to those in dry weight.

FRITZ (CLARA W.) & ATWELL (E. A.). **Decay in red-stained Jack Pine ties under service conditions.**—*Circ. Dep. Min. Resour. Can.* 58, 19 pp., 12 figs., 1941.

Some 500 railway ties of Jack pine [*Pinus banksiana*] timber affected with red stain [*R.A.M.*, xix, p. 506] were tested by the Forest Products Laboratories, Canada, for the presence of staining fungi immediately after manufacture of the ties in 1926 and after one year's seasoning in 1927; 29·8 per cent. of the cultures prepared from 415 stained samples yielded *Fomes pini* in the first, and 6·8 per cent. in the second year, while 12·5 and 20·4 per cent., respectively, yielded the unidentified organism referred to as fungus No. 2. In the following summer, half the ties were creosoted by the Rüping process and equal numbers of creosoted and untreated ties laid in a main-line railway track. Yearly examinations of the ties during a ten years' service period led to the following conclusions. The red-staining fungi are not responsible for decay of either creosoted or untreated ties under service conditions: in the former they remain viable but dormant, and in the latter they are gradually killed by advancing secondary fungi, being found alive in only about 2 per cent. of some 2,500 tests made at the end of the service period in 1939. An advanced stage of decay, most usually of a cubical type of brown rot, is caused in untreated ties by secondary fungi, most commonly by *Lenzites sepiaria* (isolated from 73 per cent. of the ties examined) and also by *Trametes americana*, *L. trabea*, *Lentinus lepideus*, *Poria vulgaris* sensu Romell, *T. serialis* (Cartwright type), *P. xantha*, one unidentified fungus which was isolated from 6·6 per cent. of ties, and several identified species which did not cause extensive rot. Creosote treatment does not sterilize the ties, but it reduces the viability of the two red-staining fungi. However, after some years, ties are rendered increasingly vulnerable to attack by secondary fungi through checks which open up the untreated wood beneath the creosoted shell.

DANILOVSKI (A.). **Mechanische Auftragung pilztötender Lösungen auf Holz.** [The mechanical application of fungicidal solutions to wood.]—*Stroit. Prom.*, xviii, 11, pp. 40–41, 1940. [Russian. Abs. in *Holz Roh- u. Werkstoff*, iv, 11, p. 407, 1941.]

The author describes a spray pistol for the application of fungicides to wood. Clogging of the apparatus is avoided by the use of two solutions which fall into very fine suspension and do not settle with undue rapidity, viz., (1) 44 per cent. sodium fluoride (43 per cent. is sufficient for less extensive decay), 28·5 (or 28) per cent. sulphite lye, 2·2 (or 2) per cent. peat dust, and 25·5 (or 26·8) per cent. water; (2) 14 per cent. sodium silicofluoride, 16 per cent. sulphite lye, 20 per cent. sodium carbonate, 5 per cent. water glass, and 45 per cent. water.

Vysozki (P. G.). **Industrieabfälle zur Pilzbekämpfung im Holz.** [Industrial wastes for fungal control in wood.]—*Stroit. Prom.*, xviii, 11, pp. 39–40, 1940. [Russian. Abs. in *Holz Roh- u. Werkstoff*, iv, 11, p. 407, 1941.]

The results of experiments with *Coniophora cerebella* [*C. puteana*] cultures showed that both a phenol-containing liquid from shale tar pitch (specific gravity 1·026 to 1·053, tenacity 1·56, alkalinity 3·3 per cent. and containing 4 per cent. crude phenols) and shale tar oils (sp. gr. 1·05, tenacity 1·86, boiling point 95° C., carbon, hydrogen, nitrogen, sulphur, and oxygen contents 75·5, 8·7, 0·6, 6·8, and 9·2 per cent., respectively, and unsaturated carbons 82 per cent.) are sufficiently toxic to protect all parts of buildings specially liable to fungal invasion. A year's practical tests corroborated these observations.

Adams (G. A.) & Ledingham (G. A.). **Biological decomposition of chemical lignin. III. Application of a new ultra-violet spectrographic method to the estimation of sodium lignosulphonate in culture media.**—*Canad. J. Res.*, Sect. C, xx, 2, pp. 101–107, 2 graphs, 1942.

In the present contribution to this series of papers [*R.A.M.*, xxi, p. 277], the authors describe an ultra-violet spectrographic method for estimating the amount of sodium lignosulphonate present in solutions. It was applied to the measurement of lignosulphonate losses in liquid media after fungi had been grown in them, and the results obtained were compared with those given by the $\beta$-naphthylamine precipitation method. The spectrographic method gave somewhat lower values than the chemical, but was free from certain errors associated with the latter. The results confirmed earlier observations that fungi are able to decompose lignosulphonates.

Hopkins (J. C. F.) & Cuthbertson (A.). **How to prevent waste. Hints on the control of diseases and pests.**—*Rhod. agric. J.*, xxxix, 3, pp. 192–201, 1942.

Brief recommendations are made for the control of vegetable diseases in Southern Rhodesia by means of sanitary measures, weed removal, and seed treatment, followed by a useful spray schedule in tabular form.

Cook (W. C.). **The Beet leafhopper.**—*Fmrs' Bull. U.S. Dep. Agric.* 1886, 21 pp., 11 figs., 1941.

In this study on *Eutettix tenellus* as the vector of sugar beet curly top in the western United States [*R.A.M.*, xix, p. 250; xxi, p. 230], the author states that as the insect is migratory and as the damage is caused by the virus it carries and not by the mass feeding of the insect alone, control by spraying is of value only if effected very soon after the leafhoppers enter a beet field, and before they have had much opportunity to spread the disease. The Bureau of Plant Industry, in co-operation with different beet-sugar companies, has developed several resistant varieties of sugar beets [ibid., xix, p. 131; xxi, p. 316]. These are being widely planted, and losses from curly top have been considerably reduced as a result. The breeding work is still in progress, and new strains are being made available as soon as they are developed. Certain varieties of bean [*Phaseolus vulgaris*], squash, and pumpkin are naturally resistant [cf. ibid., xviii, pp. 84, 296], but sugar beet is the only crop plant for which strains with resistance to curly top have been developed. Attempts are being made to develop tomato varieties and other bean varieties possessing such resistance.

In the Sacramento Valley, California, beets planted in January and February generally escape serious damage from curly top, while March and April plantings are usually severely affected. Experience has demonstrated that in the coastal districts of California, beets planted after the spring movement of the leafhopper will give a successful crop. This procedure is, however, safe only in those areas where summer breeding of the insect is unimportant, as in most localities later broods will attack the beets.

Hertzman (N.). **Klumprotsmittämnet förstöres vid ensilering.** [Club root inoculum is destroyed by ensilage.]—*Landtmannen, Uppsala*, xxv, 12, p. 256, 1941.

This is a summary of the investigations carried out by A. E. Traaen in Norway from 1936 to 1938 and described in *Meld. Norg. LandbrHøjsk.*, 1940, on the destruction of the club-root fungus [*Plasmodiophora brassicae*] in turnips and swedes by means of the AIV ensilage process, involving the sprinkling of the roots (whole or cut) with AIV acid solution at the rate of 2 or 4 l. per 100 kg. prior to placing them in the silo in October. The treated roots were cut up and mixed with sterilized sandy clay soil in pots which were then sown with the susceptible Bangholm Hundsballe swede. On examination in April the treated lots were found to be free from infection, the incidence of which in the control series amounted to 60·6 per cent. The number of spores of *P. brassicae* per gm. of soil in the pots with the treated roots was computed to range from 40,000 to 1,200,000. The ideal mode of combating club root is by the cultivation of immune or highly resistant varieties, and among the ones available on the Swedish market are Weibull's Östgöta II and Holmberg's Göta; these, while not comparable to the standard Immuna [*R.A.M.*, xx, p. 439], are definitely superior to the Bangholm strains, and promising material has been obtained through crossing Immuna with Östgöta II.

Zaumeyer (W. J.) & Harter (L. L.). **A new virus disease of Bean.**—*Phytopathology*, xxxii, 5, pp. 438–439, 1942.

Severely mottled bean [*Phaseolus vulgaris*] pods were found to harbour a virus differing from any of those hitherto recorded; it is tentatively designated as bean mosaic virus 4. Varieties (33 in all) reacting to inoculation by local lesions, consisting of roughly circular, brownish-red, necrotic areas, 1 to 3 mm. in diameter, include Corbett Refugee, Great Northern U.I. No. 59, and Red Mexican U.I. No. 34. Systemic symptoms resembling those associated with bean virus 1 [mosaic: *R.A.M.*, xx, p. 555] developed on 46 varieties, including U.S. No. 5 Refugee, Sensation Refugee Nos. 1066 and 1071, and Robust, while Idaho Refugee was heterozygous for the two sets of lesions. All the varieties mentioned by name are immune from bean virus 1. The systemic features of the new virus on the pods are dark green, irregular, water-soaked. greasy, or slimy blotches on the green-podded varieties and greenish-yellow areas on the wax-podded sorts, slight distortion, subnormal length, and terminal curling. The thermal death point of the new bean virus was found to lie between 90° and 95° C., showing it to be more resistant to heat than any other legume virus as yet described, approximating in this respect to tobacco mosaic. It was further infectious at a dilution of 1 in 500,000 and retained its virulence after 165 days ageing at 18°. It is immunologically remote from bean mosaic.

Harter (L. L.) & Zaumeyer (W. J.). **Downy mildew of Lima Beans in Colorado.**—*Phytopathology*, xxxii, 5, p. 438, 1942.

The appearance, it is believed for the first time, of downy mildew (*Phytophthora phaseoli*) [*R.A.M.*, xix, p. 330] on Lima beans [*Phaseolus lunatus*] in north-eastern Colorado in the summer of 1941, suggests either that the arid regions may sometimes become sufficiently humid for the development of the pathogen, or that the latter can adapt itself to dry conditions. The frequent rains, heavy dews, and cool nights persisting over a lengthy period were exceptional for the State. The losses in fields of the Henderson Bush, Woods Prolific, and Jackson Wonder varieties amounted to between 60 and 75 per cent. The fungus was confined to the pods, both the outside and inside of which harboured an abundance of conidia somewhat larger than those described by Thaxter in 1889; zoospores and oogonia were not detected. The only other western State from which downy mildew has been recorded on *P. lunatus* is California where it occurred many years ago, and it would therefore be of great interest to trace the source of inoculum for the 1941 epidemic in Colorado.

Ogilvie (L.) & Croxall (H. E.). **Observations on downy mildew and grey mould on glasshouse Lettuces.**—*Rep. agric. hort. Res. Sta. Bristol, 1941*, pp. 76–78, [1942].

During the winter of 1941–2, Cheshunt Early Giant, Cheshunt Early Ball, Gotte à forcer, and Early French Frame (Blackpool strain) lettuces growing in a badly heated and an unheated greenhouse became affected by *Bremia lactucae*. No significant differences in susceptibility were noted between the varieties. In the heated house, when temperature conditions were improved (the temperature rising to well over 65° F. during the day) and the lower leaves removed, the disease gave no further trouble. In the cold house the plants also gradually grew away from the disease. In tightly closed frames infection tends to persist on the lower leaves, which should be removed at intervals.

Grey mould (*Botrytis cinerea*) early became prevalent in the heated house owing, it is thought, chiefly to the considerable differences between day and night temperatures resulting in the accumulation of moisture under the lower leaves. Out of 1,536 plants, 98 Gotte à forcer, 88 Cheshunt Early Giant, 78 Cheshunt Early Ball, and 40 Early French Frame (Blackpool strain) were affected. In the cold house all varieties were almost equally affected, and the diseased plants were concentrated in damp spots caused by drips from the roof. Overhead watering of the plants in the warm house in January was followed by an alarming spread of *B. cinerea*.

Zillig (H.). **Wie entstehen Plasmopara-Epidemien?** [How do *Plasmopara* epidemics arise?]—*Z. PflKrankh.*, lii, 2–4, pp. 83–91, 2 diags., 1942.

This is a discussion of the factors concerned in the development of vine downy mildew (*Plasmopara viticola*) epidemics, with special reference to indications for the application of fungicidal treatments [*R.A.M.*, xx, p. 515], based on the author's 20 years' experience at the Bernkastel-Kues (Moselle) branch of the Biological Institute. Generally speaking, the first treatment can safely be left until after the detection of the initial outbreak on the leaves, the writer's protracted observations on this point being confirmed by those of other workers in different parts of the Rhineland and Palatinate. It is thus possible, at any rate in seasons of late infection, to defer the onset of spraying (which nearly always causes a retardation of growth or even actual injury at an early stage in the vegetation of the host) until June, so that only one application need be made before the blossom. On the other hand, it is inadvisable to postpone spraying until after the first signs of infection in the following circumstances: where it is impracticable to utilize the incubation calendar or no warning service is in operation; where the initial appearance of the mildew has not been observed when flowering is imminent; where highly susceptible varieties, e.g., Müller-Thurgau, Gutedel, and Portuguese are grown; where experience has shown that a rainy tendency is liable to develop within a given period after the treatment; and finally, if the organization of labour does not permit of spraying during the later incubation period. In the case of Riesling and other semi-resistant varieties, there is no need, in the absence of any sign of mildew in the neighbourhood, to commence spraying operations until the vines are actually in flower; should infection develop at this stage the resultant damage will ordinarily be insignificant. The year 1936 affords an illustration of these statements: the first indication of an outbreak of *P. viticola* was observed on 22nd June, when the vines were in full bloom, but in spite of the omission over a large part of the experimental zone of a pre-blossom spray, neither Riesling nor a number of other commercial varieties, e.g., several types of Burgundy, white and red Elbling, Portuguese, and Silvaner, sustained any injury; on the other hand, the tips of the first buds of Gutedel and Müller-Thurgau were killed, resulting in a 20 per cent. reduction of the harvest.

Occasionally, late (second half of June) primary infections develop into severe attacks, which may be explained by one of two alternatives: either unsuspected foci

of the disease are present in the vicinity, possibly in the form of abandoned nurseries; or the spores are conveyed to local vineyards by sudden gales from neighbouring districts where weather conditions have been more favourable to the growth of the pathogen. Instances of this kind were observed in 1937 round the Lake of Neusiedl [Austria] (verbal communication from Wahl and Voboril), in 1941 on the Upper Moselle (by Kieffer), and in 1922 in the Palatinate, where Zschokke attributed the epidemic to contamination from the heavily infested vineyards of Baden. Full particulars are given of two cases personally investigated by the writer in 1941, in which infection had spread from small and practically valueless nurseries to the adjacent commercial vineyards, causing substantial losses within a radius of 20 to 100 m.

In connexion with the foregoing observations attention is drawn to the facilities for the spread of downy mildew afforded by the reduction in the incubation period coinciding with the increasing warmth of summer. Thus, from mid-May to the end of June the duration of latency falls from 18 to 6 days, while in July and August the corresponding period is only five days, so that six attacks in a month are theoretically possible, given appropriate temperature and humidity conditions, during the later summer months compared with two in May and three in June. Within these time limits, critical days for infection fall in the latter half of June, when the third to fifth attack is commonly made, and more especially after the blossom at the beginning of July, when the fourth to sixth outbreak may be expected. The next shower following these dates conveys the spores to the young untreated grapes on which the mycelium appears after an incubation period of 10 to 14 days.

However, conditions promoting the development of *P. viticola* on the first buds and berries to the extent described only recur about every decade. On the Moselle, for instance, three out of the last 20 years have fulfilled the necessary requirements, viz., 1922, 1932, and 1941. In 1922, primary infection was observed on 26th June, a few days after the end of flowering; heavy rains in June and July were conducive to attacks on the fruit, resulting in a 'leathery' consistency. A heavy thunder shower on 13th July, 1932, led to the invasion of the young unsprayed grapes, all of which were white with the mycelium of the fungus after a fall of rain on the 30th. In 1941, heavy showers on 12th and 13th July permitted the entry of the organism into the grapes, which were covered with white mycelium after further rain on the 28th. In 1932 and 1941 the flowering periods closed on 3rd and 7th July, respectively, allowing only 10 and 6 days, respectively, for the application of the post-blossom sprays: in the latter year, moveover, many vintners, in consequence of haymaking and war-time exigencies, were unable to complete the necessary control measures during the brief space allotted, with resultant severe losses.

Tartakowsky (S. J.) & Arentsen (S. T.). **La antracnosis de la Vid.** [Vine anthracnose.]—*Bol. Sanid. veg., Santiago*, i, 1, pp. 7–18, 1941.

A fairly severe epidemic of vine anthracnose (*Elsinoe ampelina*) during the season of 1940–1 in Chile (where the disease was first diagnosed in 1876) afforded an opportunity for field investigations in the affected provinces of Ñuble, Concepción, Bío-Bío, Malleco, and Cautín, where the warm and exceptionally humid conditions required by the pathogen prevail. The most susceptible variety was found to be Negra País, constituting 90 per cent. of the total acreage under vines, followed by Blanca de Italia, Moscatel de Alejandría, Rosadá de Curtiduría, Torrontés, and San Francisco, while Cot Rouge showed a fair degree of resistance. Out of a total area of 102,237·45 ha. covered by the vineyards under inspection, *E. ampelina* was found on 22,300·74, causing losses of up to 80 or 100 per cent. Good control may be achieved by a dormant application of 2 per cent. neutral Bordeaux and two spring treatments (or more if weather conditions require) with the same mixture, one when the buds are 10 to 15 cm. long and the second just before flowering.

Jenkins (Anna E.) & Bitancourt (A. A.). **Antracnosis de la Vid en Chile.** [Vine anthracnose in Chile.]—*Bol. Sanid. veg., Santiago*, i, 1, pp. 19–53, 3 figs., 1 map, 1941.

Documents and published papers relating to the early history of vine anthracnose (*Elsinoe ampelina*) in Chile [see preceding abstract] and elsewhere are transcribed, and the past and present status of the disease discussed, with special reference to its distribution in Chile.

Altstatt (G. E.). **Diseases of plants recorded in Texas since 1933.**—*Plant Dis. Reptr, Suppl.* 135, pp. 37–50, 1942. [Mimeographed]

A list is given, arranged under the Latin names of the hosts, of the plant diseases caused by fungi, bacteria, viruses, or physiological factors, recorded in Texas since 1933. New host plants of the cotton root rot fungus (*Phymatotrichum omnivorum*) found since 1936 [*R.A.M.*, xvii, p. 674] are included.

Fawcett (G. L.). **Departamento de Botánica y Fitopatología.** *Ex* **Memoria anual del año 1941.** [Department of Botany and Phytopathology. *Ex* Annual Report for the year 1941.]—*Rev. industr. agríc. Tucumán*, xxxii, 1–3, pp. 41–45, 2 figs., 1942.

The following items of interest occur in this report [cf. *R.A.M.*, xxi, p. 5]. The most important sugar-cane disease investigated during the period under review was smut (*Ustilago scitaminea*), which occurs throughout Tucumán, though mostly to a limited extent, as well as in the provinces of Salta and Jujuy, the P.O.J. 36 variety being the most severely attacked, while P.O.J. 213 is little affected.

'Black pest' [spotted wilt: loc. cit.] was not much in evidence among the 1941 tomato crops, appearing only towards the end of the harvest and causing negligible damage. In one plot of 150 plants, 30 were sprayed with wettable sulphur about the end of December, and of these 14 developed symptoms of spotted wilt, and four died; of the untreated, 87 died and all the rest contracted infection. In another bed 56 plants sprayed with lime and a small quantity of adhesive oil (citromulsion) all remained healthy, while 17 of the remaining 49 died. It was experimentally demonstrated that the virus responsible for 'black pest' of tomatoes and 'corcova' of tobacco causes symptoms in the chilli [ibid., xix, p. 255] similar to those on tomato.

*Eucalyptus propinqua* seedlings, and to a lesser extent those of *E. saligna*, *E. citriodora*, and *E. maculata*, were observed to suffer from a graft-transmissible virus disease characterized by chlorosis and stunting of the foliage. *E. punctata*, *E. tereticornis*, and *E. rudis* are resistant to the trouble, from which *E. dwyeri* appears to be quasi-immune.

Garrett (S. D.). **The take-all disease of cereals.**—*Tech. Commun. Bur. Soil Sci., Harpenden*, 41, 40 pp., 5 figs., 1942. 2*s*. 6*d*.

In this paper the author reviews and critically discusses the present state of knowledge concerning take-all disease of cereals (*Ophiobolus graminis*), the points dealt with including, among others, geographical distribution, symptoms, physiology, morphology, and pathogenicity, effect of soil and climatic factors on prevalence, life-cycle, origin and dispersal of the disease, effects on the disease of microbiological antagonism and soil temperature and moisture, and, finally, control. A bibliography of 136 titles is appended.

Chester (K. S.). **A suggested basis for the prediction of Wheat leaf-rust epiphytotics.**—*Plant Dis. Reptr*, xxvi, 9, pp. 213–217, 1942. [Mimeographed.]

As the outbreak of wheat leaf rust (*Puccinia triticina*) experienced in Oklahoma in 1942 was only a very light one in spite of the fact that it was preceded by weather conditions generally supposed to be conducive to heavy infection (i.e., abundant

inoculum during autumn, a mild winter, and a wet spring), the author made a detailed study of the records of local weather and rust occurrence for the period 1918 to 1941.

These 23 years included eight when losses ranged from 5 to 27 per cent., ten when the figures were 2 to 5 per cent., and five when they were 0 to 2 per cent. In every instance in the first group the winter was mild; precipitation in January and February was normal or above; March temperatures and precipitation were normal or above; and the autumn months and April varied from very warm to cool and very wet to very dry. Conditions favouring leaf rust do not necessarily include excessive rainfall, but the absence of subnormal deficiency of temperature or rainfall during the critical period from December to the end of March appears to be essential. In every year in the second group (moderate infection) one of these factors was lacking (occasionally two); winter temperatures were severe, or March was cool to cold or dry to very dry. When infection was only very light, two or three of the essential factors in the period late winter-March were wanting. In the last two groups the weather experienced in late autumn and April bore no consistent relation to subsequent outbreaks. These observations explain the situation in 1942. Throughout the critical period, temperatures favoured infection, but most of the rainfall came before or after the critical period, January and March being notably dry. Thus, 1942, according to the author's views, would be a year of moderate or light infection, in spite of the excessive moisture and rapid rust development in April.

If the conditions necessary for an epidemic outbreak are fulfilled 2½ months before harvest and losses thereafter are relatively independent of the weather, it should be possible in the latitude of Oklahoma to forecast on 31st March the approximate damage by harvest time in June. This could be done by observation of the rust severity at the time or by analysis of the weather record from December to March, inclusive. For other latitudes correspondingly earlier or later dates would apply. The forecasts would be too late to be of use in control, but early enough to make it possible in years of severe epiphytotics to reduce losses by harvesting the wheat for hay and planting some other crop.

WARK (D. C.). **The influence of storage in contact with certain seed-pickling dusts on the germination of grain.**—*J. Aust. Inst. agric. Sci.*, viii, 1, pp. 22–25, 1942.

Ranee wheat seed, untreated and treated with nine different dusts, was stored for 0, 2, 4, 6, and 8 weeks at 0°, 10°, 20°, and 30° C., all the different lots being sown on the same day. The dusts used, which were all applied at the rate of 2 oz. per bush., were (*a*) and (*b*) two experimental dusts containing 1·5 per cent. of mercury, (*c*) a dust containing 1·5 per cent. of mercury as ethyl mercury phosphate, (*d*) containing 1 per cent. of mercury as ethyl mercury phosphate, (*e*) containing 1·5 per cent. of mercury including 0·15 per cent. as ethyl mercury phosphate, (*f*) agrosan, containing 1·5 per cent. of mercury, (*g*) an experimental dust, the active principle being a sulphur-containing organic compound, (*h*) a mixture of cuprous oxide and talc, and (*i*) copper carbonate.

The results showed that the undusted seed grain stored in closed containers at 0° or 30° gave a significantly lower germination than the undusted stored at 20°. The effects of the dusts were as follows. Without storage, those with ethyl mercury phosphate as the active principle improved germination, (*d*) to a significant extent, (*c*) and (*e*) not. Storage of treated grain, however, reduced percentage germination where (*c*) and (*d*) were used, reduction being more rapid at the higher concentration of ethyl mercury phosphate than the lower. Storage temperature was an important factor in this deterioration. Dust (*a*) applied to wheat seed-grain on the day of planting failed to increase germination; improvement set in with storage, and appeared to be greater at temperatures of 10° or over, but the differences were not significant. Dust (*b*) applied immediately before sowing improved germination. This improvement was significantly reduced on storage, reduction being independent of

the storage temperature. Dust (*h*) significantly improved germination of seed-grain sown on the day it was dusted, in contrast to (*i*), but after two weeks' storage both dusts significantly increased germination. It is concluded that dusts of type (*c*) and to a less extent (*d*) and (*b*) are unsuitable for commercial grain disinfection under South Australian conditions. For testing new materials, a field germination test is recommended, in which dusted grain stored for eight weeks at 30° is compared with undusted and freshly dusted grain.

In a second experiment, Californian Cape barley was stored for 0, 4, 8, and 12 weeks at 10°, 20°, and 30° after dusting (2 oz. per bush.) with (*a*) agrosan, (*b*) ceresan, (*c*) dust (*b*) of the first experiment, (*d*) an experimental dust containing 1·5 per cent. mercury, including 0·15 per cent. as ethyl mercury phosphate, (*e*) a dust containing 1 per cent. mercury as ethyl mercury phosphate, (*f*) a dust containing 1 per cent. mercury as ethyl mercury phosphate, to which indolyl-acetic acid $\beta$ had been added to give a concentration of 2·5 p.p.m. of the dry weight of the seed, and (*g*) undusted. The treatments were replicated six times. In contrast to the results with wheat, none of the dusts depressed germination even with 12 weeks storage at 30°, and all except (*b*) and (*e*) significantly improved germination after storage.

MILLIKAN (C. R.). **Symptoms of zinc deficiency in Wheat and Flax.**—*J. Aust. Inst. agric. Sci.*, viii, 1, pp. 33–35, 3 figs., 1942.

When Free Gallipoli wheat was grown in zinc-free water cultures at the Plant Research Laboratory, Burnley, Victoria, after three or four weeks the plants were observed to be less tall than the controls, while tillering was reduced, and the youngest leaves were pale green. A few days later, irregular, opaque, greyish-green, collapsed spots appeared on these leaves. The spots soon dried out and became light brown or whitish, the remainder of the leaf finally dying. Growth became very restricted, and later-formed leaves were small and chlorotic. The plants failed to grow beyond the seedling stage, whereas the controls were 4 ft. high at the close of the experiment. The leaf symptoms have not been observed on cereals growing on Wimmera black soil, though zinc sulphate applications have brought about considerable improvement in growth and yield [cf. *R.A.M.*, xxi, pp. 69, 125].

Liral Crown flax grown in the same container as the wheat seedlings usually developed characteristic symptoms about one week earlier. Growth in the water cultures became markedly checked in two to three weeks, and soon afterwards greyish-brown, collapsed spots appeared in the centre or on the lower half of the youngest leaves. These lesions soon dried and turned light brown to white. On later-formed leaves the spots were bronze. Occasionally, these leaf symptoms were preceded by a small bronze spot on the under side of the petiole, at the point of juncture with the main stem. The part of the main stem nearest the affected leaves became rusty-brown, and very little growth occurred above the affected area. The internodes between leaves became very short, giving the top of the plant a rosette-like appearance. Later, the top of the main stem became necrotic, and all the lower leaves dried from the tip downwards, though the stem remained green for some time. Meantime, secondary shoots were produced from the base, the leaves on these shoots developing bronze spotting, followed by necrosis of the leaves from the tip. Finally, the whole plant died. Normal growth was resumed when zinc was applied before the symptoms became very severe. Similar symptoms have been observed on Liral Crown flax growing in Wimmera black soil in the field.

JOHNSON (F.). **Heat inactivation of Wheat mosaic virus in soils.**—*Science*, N.S., xcv, 2476, p. 610, 1942.

Soil infected with wheat mosaic virus (*Marmor tritici* H.) and at optimum moisture content was passed through a screen of ¼ in. mesh, placed in stoppered test tubes, and heated at 40°, 50°, 60°, 70°, and 80° C. in a water bath for 10 minutes. Seed

of Purdue No. 1 wheat was planted in the treated soil in tin cans and the plants were kept outdoors through the winter. All the plants in the soil heated at 40° and 50° developed mosaic, while all the others remained unaffected.

Livingston (J. E.). **The inheritance of resistance to Ustilago nuda.**—*Phytopathology*, xxxii, 6, pp. 451–466, 2 graphs, 1942.

At the Nebraska Agricultural Experiment Station the inheritance of resistance to the brown loose smut of barley (*Ustilago nuda*) was studied in the hybrid offspring of two susceptible and two resistant varieties [cf. *R.A.M.*, xi, p. 775], the percentages of infected plants in the $F_1$ of which were as follows: Colsess IV (susceptible) × Trebi (resistant) 6·25, reciprocal 3·51, Trebi × Missouri Early Beardless (susceptible) 1·19, and Missouri Early Beardless × *Hordeum deficiens* (resistant) 0·0. Both Trebi and *H. deficiens* appear from these data to possess a dominant factor for resistance, which may not, however, always be complete. The $F_2$ progenies from crosses between each of the resistant varieties and Missouri Early Beardless developed a comparable incidence of infection, indicating that the resistance factors carried by the two resistant parents exerted similar effects: in this and succeeding generations resistant individuals preponderated.

The susceptibility of $F_2$ hybrids from a Colsess IV × Missouri Early Beardless cross (58·97 per cent. infected plants) approached the infection limits of the latter parent but was less than that of the former, denoting the existence of a weak resistant factor in Missouri Early Beardless. The reactions of the $F_1$ of selfed back-cross offspring corroborated the evidence already secured as to the presence of a single dominant factor for resistance in Trebi and *H. deficiens.*

No correlation could be established between the factors for resistance to loose smut and those governing the hooded and six-rowed characters, promising selections of barleys combining all three of which were developed.

Rosen (H. R.). **Overwintering of crown rust of Oats in Arkansas in 1941–42.**—*Plant Dis. Reptr*, xxvi, 5, pp. 119–120, 1942. [Mimeographed.]

On 3rd March, 1942, *Puccinia coronata* was found on Lee oats at Fayetteville, Arkansas, following a severe outbreak in the same field in the autumn of 1941. By 13th March some of the pustules were shedding uredospores, and the evidence obtained left small doubt that the rust had overwintered in the uredo stage, though the amount of overwintering represented only a minute fraction of the initial number of infections.

Hoppe (P. E.). **Relative prevalence and geographic distribution of various ear rot fungi in the 1941 Corn crop.**—*Plant Dis. Reptr*, xxvi, 6, pp. 145–149, 1 fig., 1942. [Mimeographed.]

This report is on the same lines as those of previous years [*R.A.M.*, xx, p. 528].

Guseff (M.). **Eine neue Maiskrankheit.** [A new Maize disease.]—*Müll. ElevWirtsch.*, *1940*, 7–8, pp. 61–62, 1940. [Russian. Abs. in *Zbl. Bakt.*, Abt. 2, cv, 7–9, p. 158, 1942.]

Stored maize [in the U.S.S.R.] has contracted a new type of infection by species of *Penicillium* [*R.A.M.*, xxi, p. 184], which develop between the embryo and the aleurone layer, inducing a blue or dark discoloration of the former. The minimum moisture content of the grain at which infection can originate is 16·7 per cent.

Schindler (A. J.). **Insect transmission of wallaby ear disease of Maize.**—*J. Aust. Inst. agric. Sci.*, viii, 1, pp. 35–37, 1 fig., 1942.

Late-planted maize in many parts of south-eastern Queensland is affected by a disease, referred to locally as 'wallaby ear'. The first symptoms generally develop

towards the end of January. Crops fully grown at this time may be scarcely affected, but plants that have recently been sown may become a complete loss. Small swellings appear on the secondary veins on the under surface of the top leaves. In young maize the veins rapidly swell from the tip of the leaf to the sheath, the plant is dwarfed and abnormally deep green, pollen yield is reduced, silk growth is slow, and cob and grain growth is much retarded. No organism causing the disease could be found.

In tests of possible vectors, maize plants in four out of five cages exposed to *Cicadula bimaculata* (which was prevalent on affected plants) and *Peregrinus maidis* developed the disease in about three weeks; in two cages exposed to *C. bimaculata* alone it developed in about the same time; and in one cage exposed to *P. maidis* it failed to develop in 18 days. No control plant became affected. It is evident that the disease, which is probably due to a virus, is carried by jassids prevalent after midsummer, and mainly by *C. bimaculata*.

Leukel (R. W.). **Spergon as a seed disinfectant.**—*Plant Dis. Reptr*, xxvi, 4, pp. 93 94, 1942. [Mimeographed.]

In May, 1940, seed of Sharon kafir sorghum was inoculated with the spores of covered kernel smut [*Sphacelotheca sorghi*] at a 1–100 spore dosage, treated with new improved ceresan (½ oz. per bush.), copper carbonate (3 oz. per bush.), or spergon [*R.A.M.*, xxi, p. 360 and below, p. 511] (3 oz. per bush.), and planted in the field at Beltsville, Maryland, and Hays, Kansas. In the former locality the three treatments gave, respectively, 0, 0, and 0 per cent. smutted heads, as against 55 per cent. in the untreated controls, and in the latter 0, 1, and 0 per cent. as against 37 per cent. smutted heads in the controls. Seed of 'feterita' and kafir sorghum treated in the same way was also planted in the greenhouse, when the treatments gave 62, 62, and 75 per cent. emergence for 'feterita' (as against 44 per cent. for the control) and 87, 87, and 88 per cent. emergence for kafir, as against 80 per cent. for the control.

Kulkarni (G. S.). **Ergot in India.**—*Curr. Sci.*, xi, 6, p. 246, 1942.

Referring to a recent note on sorghum ergot (*Sphacelia sorghi*) [? *Claviceps pusilla* or *C. purpurea*] in India [*R.A.M.*, xxi, p. 206], the writer states that the first collection of the fungus was made by him at Dharwar in 1915, and may now be inspected in the herbarium of the Poona Agricultural College, infection being subsequently observed on *Andropogon annulatus*, *A. caricorus*, *Ischaemum pilosum*, and *Pennisetum alopecuros*. In the Bombay Karnatak the organism is prevalent and injurious, especially on late-sown sorghum. On *P. alopecuros* the dark, sticky, bent sclerotia are prominent.

G. W. Padwick states in a footnote that the first description (as distinct from a mere record of discovery) of *S. sorghi* was published by McRae in 1917, the spore measurements of his specimen being given as 7·6 to 16 by 4 to 6 $\mu$ as compared with a maximum of 3·6 to 11 by 1·8 to 4·6 $\mu$ for the Simla hill collections.

Cross (W. E.). **Actividades de la Sección Fomento Agrícola durante el segundo semestre de 1941.** [Work of the Division for Agricultural Promotion during the second half of 1941.]—*Publ. Estac. esp. agríc. Tucumán* 19, 14 pp., 1941.

In connexion with a report on a citrus exhibition organized by the Rural Society of Jujuy, Argentine, in July, 1941, mention is made of the devastation caused in the orange and grapefruit groves of Entre Ríos and Corrientes by root rot [*R.A.M.*, x, p. 24], the disease being described as a 'scourge' of trees grafted on the sour orange stocks introduced with successful results for the control of gummosis [*Phytophthora citrophthora* and *P. parasitica*: ibid., xix, p. 341]. So far, the causal organism of root rot has not been established, and the only known remedy consists in the substitution of Persian and Rangpur limes for sour orange as stocks. Other destructive citrus

maladies include 'lepra explosiva' [ibid., xv, p. 14] and cancrosis B or false canker, the effects of the second of which may surpass those of all the other troubles enumerated.

Rhoads (A. S.). **Growing new root systems by soil banking—a promising method of rejuvenating trees attacked by root diseases.**—*Phytopathology*, xxxii, 6, pp. 529–536, 3 figs., 1942.

For the last 15 years at the Florida Agricultural Experiment Station the author has successfully combated foot rot (*Phytophthora parasitica*) in orange and grapefruit and root rot (*Clitocybe tabescens*) [see below, p. 497] in Australian pine (*Casuarina lepidophloia*) and other trees and shrubs by banking clay soil round the base of the trunk to a height of 15 to 18 in. to stimulate the natural tendency of the parasitized host to adventitious root development as a means of overcoming the disease, this process occupying a period ranging from two to five years. In some cases it may be advisable to combine the soil-banking method with previous surgical treatment, disinfection, and aeration. The operations under discussion afford the sole practicable means of saving old sweet seedling orange trees in which foot rot has induced such extensive deterioration as to preclude success by the standard practices of rejuvenation.

Loest (F. C.). **'Dry root rot' disease of Citrus trees.**—*Fmg S. Afr.*, xvii, 196, pp. 420–424, 5 figs., 1942.

A condition known locally as 'dry root rot' has caused the retrogression and death of citrus trees throughout the Union of South Africa. A permanently wilted condition of the leaves develops on certain sections of the tree or over the whole of it, the affected branches showing complete defoliation. Sectional defoliation may continue for years before the entire tree loses its leaves and dies. Sometimes, the tree wholly or partially defoliates without showing any permanent wilt, such defoliation lasting either a short or a long time. In the latter case, the foliage gradually 'thins' and small, mottled leaves often develop on the defoliating branches. This 'thin' condition is often due, however, to faulty nutrition and not to dry root rot. Gum exudation from cracks in the bark of dying-back twigs and branches is characteristic of Triump grapefruit trees affected by dry root rot. The last remunerative crop borne is generally a heavy one. In the early stages of the disease, the fibrous root system sloughs off, and the long secondary roots have no fibrous roots, and eventually decay. The crown roots next become affected, and the bark on the trunk splits and cracks, partially or completely collapsing over the whole trunk or part of it. The appearance of the affected fibrous secondary and crown roots is similar, the bark becoming detached from the main cylinder and readily removable in long shreds. Death of the bark is followed by the death of the cambium and wood. At first, the bark is soft and moist, but later it becomes dry and brittle, while the wood underneath is dead and hard, and eventually becomes corky and powdery. When the roots show an advanced stage of the rot, the bark (except the epidermal layer), the cambium, and the wood become biscuit-coloured, light brown, light dirty brown, pepper- or blackish-grey. The bark, except the epidermal layer, is often almost black to jet-black, the black bark frequently adhering as a crust.

Proof was obtained that the causal agent is *Diplodia natalensis* [*R.A.M.*, xxi, p. 128]. Contributing factors are (1) impaired soil aeration, due to over-irrigation especially of heavy soils or over hard pans or impervious subsoils, (2) a low nitrogen level, due to the same cause, and (3) the planting of weak trees or excessive root pruning.

Control consists in not planting trees in soils with an impervious subsoil, not cultivating the soil before it is sufficiently dry, avoiding any excessive supply of water

and the severance or bruising of roots, and supplying a sufficient amount of available nitrogen. In advanced stages control is often impossible.

Dastur (J. F.). **Pink disease of Orange trees in the Central Provinces.**—*Indian J. agric. Sci.*, xi, 6, pp. 892–901, 3 pl., 1941 (issued 1942).

Pink disease (*Corticium salmonicolor*) of oranges appears to be confined to four districts in the Central Provinces, in only one of which (Balaghat) does it occur in epidemic proportions. The fungus may assume various forms, including those known as the 'spider's web', sterile pustular, *Necator decretus* [*R.A.M.*, vi, p. 125], and basidial. The silvery-white, later pink, and finally dirty drab mycelium of the 'spider's web' stage is mainly superficial, penetrating the bark only through wounds; the thin-walled, sparsely septate hyphae, 7 to 15 $\mu$ in breadth, form loose aggregates of cells over thin-walled lenticels and ruptured tissues. The sterile pustules may be either white or pink to orange-reddish, the former developing both on the exterior of the cortex and within the bark tissues, while the latter originate in the subepidermal layers. The *N. decretus* pustules at first resemble the sterile structures, but are readily distinguishable from the latter on the production of unicellular, hyaline (pink in the mass), angular or rounded spores, 8 to 20 by 5 to 10 $\mu$, which are formed by the separation of the cells composing the pseudoparenchymatous tissue. On rare occasions the basidial stage is formed; the basidia, 16·6 to 33·2 by 5 to 8 $\mu$ in diameter, are developed from the hymenium in rows or scattered, but remain sterile, bearing neither sterigmata nor basidiospores.

Dormant mycelium of *C. salmonicolor* has been observed in the callus surrounding cankers in the cortical tissues of a fork while a *Nectria* and a *Diplodia* species are associated with the disease. The mycelium of the *Diplodia* develops inside the cortex, and the pycnidia arising from the stromata in the bark tissues rupture the epidermis. It is not improbable that primary infection by *C. salmonicolor* may be in part through bark killed or weakened by *Diplodia* sp.

The inoculation of two- to three-year-old orange and sour lime trees at Nagpur with pure cultures of *C. salmonicolor* isolated from orange and mango gave positive results, but there was no spread of infection during the subsequent wet season to healthy plants in the same greenhouse, or even to the sound limbs of the inoculated trees.

Control measures should consist in the excision of cankers during the dry weather and the application to the wounds, and also to the forks of the trees, of a standard fungicide, such as creosote oil or Bordeaux paste.

Presley (J. T.). **Cotton rust in Arizona.**—*Plant Dis. Reptr*, xxvi, 6, pp. 144–145, 1942. [Mimeographed.]

During 1941 cotton rust (*Aecidium gossypii*) [*R.A.M.*, xxi, p. 253] was present over a large area in Arizona, the outbreak being favoured by the prevailing weather conditions and the increased acreage of cotton on desert land. The *Bouteloua* grasses, which are alternate hosts of the fungus, are native to the south-west parts of the United States and may be expected to grow abundantly on most desert lands when water is supplied, either by irrigation or rainfall. On ditch banks and in cotton fields where moisture is available the grass will grow for most of the summer, and reach a size many times that found in the desert; it is on this grass, in and immediately surrounding the cotton field, that most of the rust inoculum is built up. Directly a rainy period sets in, the teleutosori on the infected grass germinate and the cotton becomes diseased. Grass in a cotton field may be attacked early in the summer and re-infect the same field later in the same growing season, if weather conditions are favourable; teleutosori forming on the grass soon after infection are at once viable and may germinate within 48 hours.

The following suggestions are made to assist in control. Dead, rusted grass in and

round cotton fields should be destroyed by burning where possible, before the arrival of the summer rains, and improved sanitary practices instituted, especially with regard to ditch and fence rows. Fungicidal treatment, though possible, would be expensive and difficult.

DRECHSLER (C.). **New species of Acaulopage and Cochlonema destructive to soil amoebae.**—*Mycologia*, xxxiv, 3, pp. 274–297, 6 figs., 1942.

In this paper [cf. *R.A.M.*, xx, p. 462], full descriptions are given of three conidial Phycomycetes, apparently not before described, destroying particular species of terricolous amoebae. Two are presented as new members of the predaceous genus *Acaulopage* [ibid., xiv, p. 508], viz., *A. lasiospora* n.sp. and *A. gomphoclada* n.sp., while the third is set forth as a new member of the parasitic genus *Cochlonema* [ibid., xiv, p. 360], *C. euryblastum* n.sp. A morphological variant of *C. bactrosporum* is described as a new variety, *C. bactrosporum* var. *longius* var. nov. Supplementary findings are reported on the vegetative stage of *A. tetraceros* and on the asexual reproductive stage of *Stylopage cephalote* [ibid., xvii, p. 597].

COSTA (G. A.). **Nota sôbre a conservação de cogumelos pelo dessecamento.** [Notes on the preservation of fungi by desiccation.]—*Rev. bras. Biol.*, i, 2, pp. 155–159, 1941. [English summary.]

The writer's experiments at the Oswaldo Cruz Institute, Rio de Janeiro, showed that a number of dermatophytes and yeasts could be maintained in a viable condition without undergoing pleomorphism for periods up to ten months by desiccation in vacuum at low temperatures.

TAGER (M.) & LIEBOW (A. A.). **Observations on histoplasmosis: induced infections in the Mouse.**—*Yale J. Biol. Med.*, xiv, 5, pp. 469–488, 15 figs., 1942.

A thoroughly documented survey of the increasingly important disease of histoplasmosis (*Histoplasma capsulatum*) precedes this detailed account of the author's inoculation experiments with mycelial suspensions of the fungus from honey agar on mice, the pathological changes induced in which are essentially analogous to those associated with the advanced process in man. A bibliography of 44 titles is appended.

KEY (J. A.) & LARGE (A. M.). **Histoplasmosis of the knee.**—*J. Bone Jt Surg.*, N.S., xxiv, 2, pp. 281–290, 4 figs., 1942.

Full clinical details are given of a case of histoplasmosis (*Histoplasma capsulatum*) of the knee in a 47-year-old male patient at the Barnes Hospital, St. Louis, Missouri, believed to be the first on record of involvement of a joint. A further point of interest lies in the resemblance of the symptoms to those of tuberculosis, a diagnosis of which was made but rejected on the negative outcome of tuberculin tests and guinea-pig inoculations.

CONANT (N. F.). **Laboratory study of Blastomyces dermatitidis Gilchrist & Stokes, 1898.**—*Proc. sixth Pacif. Sci. Congr., 1939*, pp. 853–861, 3 figs., 1939. [Received August, 1942.]

The importance of fungi as causative agents of disease in man is apparent when it is stated that the American blastomycosis (Gilchrist's disease) has a higher mortality than tuberculosis. Although a tentative diagnosis of the disease may be made on the basis of large double-contoured budding cells in the sputum, urine, spinal fluid, etc., final diagnosis can only be established by isolating the causal organism *Blastomyces dermatitidis* [*R.A.M.*, xxi, p. 370]. Several fungi may be cultured from blastomycotic lesions, but it is the purpose of this paper to show that *B. dermatitidis* Gilchrist & Stokes, 1898, is the etiologic agent.

After further reviewing the literature the author reports his studies on cultures isolated at the Duke Hospital, North Carolina, and various named cultures received

from other workers. The pure cultures were obtained by streaking infected material on Sabouraud's glucose agar and blood agar and making transfers from suitable colonies. All the strains were allowed to develop cottony filamentous growths on Sabouraud's glucose agar at room temperature, heavy transfers were made on blood agar slants at 37° C., and within seven to ten days yeast-like areas appeared which on transference to fresh blood agar slants at 37° developed into glistening, sometimes smooth but often heaped, cerebriform, yeast-like cultures, containing budding cells similar to those found in lesions. When the yeast form on blood agar at 37° was transferred to Sabouraud's glucose agar at room temperature the mycelial growth ultimately became dry and cottony and coremia appeared, giving the cultures a prickly appearance. Eventually the entire culture became cottony. In both the prickly and filamentous stages numerous conidia were produced. These were either sessile, round to oval, 3 to 4 $\mu$ in diameter and attached to the hyphae near the septa, or round to piriform, 4 to 5 $\mu$ in diameter, and borne on lateral sterigmata of varying lengths. Many raquette cells were also present. In the old filamentous cultures many intercalary and terminal chlamydospores were seen. These were brown, thick-walled, 7·5 to 18 $\mu$ in diameter, and in many the outer walls were thickened to simulate sculpturing and closely resemble the chlamydospores of *Scedosporium apiospermum*. Intraperitoneal inoculations of the yeast form into mice rapidly proved fatal.

Fungi previously described as *Glenospora gammeli* (1927), *Blastomycoides tulasnensis* (1928), *Endomyces capsulatus* (1929), *E. c.* var. *isabellinus* (1933), *E. dermatitidis* (1933), and *G. brevis* (1933) were found by the author to be identical with *Blastomyces dermatitidis* and should be reduced to synonymy. The author admits that the genus *Blastomyces* had been erected by Costantin and Rolland in 1888 for *B. luteus*, but he considers that confusion would be avoided if the name *B. dermatitidis* were retained until some definite agreement can be reached on the point. In a personal communication from Ciferri and Redaelli referred to in the bibliography these authors stated that their descriptions were based entirely on Moore's work [ibid., xiv, p. 582].

MUSKETT (A. E.) & COLHOUN (J.). **Biological technique for the evaluation of fungicides II. The evaluation of seed disinfectants for the control of seed-borne diseases of Flax.**—*Ann. Bot., Lond.*, N.S., vi, 22, pp. 219–227, 1942.

In the second contribution to this series [*R.A.M.*, xvii, p. 809] results are given of a comparison between a laboratory and a field method of evaluation of seed disinfectants for the control of stem-break and browning (*Polyspora lini*) and seedling blight (*Colletotrichum lini*) [ibid., xx, p. 335] of flax. The laboratory technique was an adaptation of the Ulster method previously described by Muskett and Malone [ibid., xx, p. 261], but the time of incubation of the plates was increased from five to seven days. The field method consisted in sowing disinfected seed in randomized blocks and making frequent observations on the development of disease during the growing season. The fungicides used were formalin (1 in 50, 60, 70, or 80), cuprous oxide and several proprietary materials containing organically combined mercury or tetramethylthiuram disulphide [ibid., xxi, p. 283].

Data collected during the experimental years from 1939 to 1941 showed a close agreement between the results obtained by the two methods. The correlations of the mean values obtained for treatment in the field with the corresponding ones arrived at in the laboratory were all statistically highly significant. It is concluded that the evaluation of seed disinfectants by the laboratory technique may be regarded as reliable and accurate.

STRAIB (W.). **Beiträge zur Epidemiologie und Bekämpfung des Flachsrostes.** [Contributions to the epidemiology and control of Flax rust.]—*Angew. Bot.*, xxiv, 1–2, pp. 16–30, 1942.

The causal organism of flax rust, *Melampsora lini*, was shown by field experiments

near Brunswick and in East Prussia [*R.A.M.*, xix, p. 280] in 1940–1 on the Lusatia and Bavarian Mountain varieties to traverse its entire life-cycle on the same host. The diseased straw yielded, in addition to physiologic race D–1 (found occurring spontaneously in 1938 on the Gliesmarode experimental plots and differing from all recorded European races of the rust in its high maximum temperature for uredospore germination, namely 30° C. as against 25° to 27° for the rest), a new race, herein designated D–16, which is characterized by severe pathogenicity to the ordinarily resistant Kenya variety, as well as to 'very pale blue crimped' and other sorts resistant to D–1. On the other hand, no variety was observed, among the 400 tested, to show a higher degree of resistance to D–16 than to D–1, the new race, therefore, as in the case of *Puccinia glumarum* on wheat, representing a progressive intensification of 'aggressiveness' [ibid., xvi, p. 372 *et passim*]. In its temperature relations D–16 agrees with D–1, from which it is presumed to have sprung through the recombination of genes incidental to heterothallic fungi [ibid., xiv, pp. 170, 309]. The removal of infected flax straw from the field (which is assisted by the cultivation of a winter crop in succession to flax) thus assumes great importance as a control measure against the rust, but more significant still are the possibilities of breeding resistant varieties, some experiments in connexion with which have already been reported (*Arb. biol. Anst.* (*Reichsanst.*), *Berl.*, xxiii, pp. 233–263, 1941; *Faserforsch.*, xiv, pp. 97–113, 1941). Many varieties with susceptible foliage have been observed to possess resistant stems, and for all practical purposes the capacity to withstand infection of the latter organs is quite sufficient, since damage to the fibres occurs mostly from the teleutosori forming crusts over the stem surface. Among such varieties may be mentioned Svälofs Hercules, Concurrent, and Karnobat No. 9, the last-named an oil-yielding sort. Estanzuela 117 is uniformly resistant from the seedling stage onwards, whereas Eckendorfer Early, Lusatia, and Bavarian Mountain are altogether susceptible. This resistance of the stems to *M. lini* appears, from experimental data obtained of recent years, to be largely independent both of physiologic specialization within the rust and of environmental conditions.

Waterhouse (W. L.) & Watson (I. A.). **A note on determinations of physiological specialisation in Flax rust.**—*J. roy. Soc. N.S.W.*, lxxv, 3, pp. 115–117, 1 pl., 1942.

Determinations of ten collections of *Melampsora lini* [*R.A.M.*, xxi, p. 454] from widely separated areas in Australia showed the presence of only one physiologic race, the reactions to which of 11 differential varieties of flax proved it to be different from any of the races recorded by Flor [ibid., xix, p. 655]. This was corroborated by Flor in personal correspondence. Further, the variety Bison C.I. No. 389 remained immune in all the authors' tests, though it was susceptible throughout the American experiments. In addition, the variety Argentine C.I. No. 705–1 which was used by Flor and supplied by him to the authors, remained immune in Australia, though immune only from race 10 in America; the reactions of this race on other differentials of the group were totally different from those of the authors' race. Further work is in progress.

D'Oliveira (Maria de L.). **Um virus das Liliaceae em Portugal.** [A virus of Liliaceae in Portugal.]—*Agron. lusit.*, iii, 2, pp. 115–120, 1 pl., 1941. [English summary.]

Attention has already been drawn to the occurrence in Portugal of a virus disease of onions, grape-hyacinth (*Muscari comosum*), and *Narcissus tazetta* characterized by symptoms resembling those of yellow dwarf [*R.A.M.*, xxi, p. 243], which were transmitted by rubbing, using carborundum as an abrasive, from diseased to healthy plants in a very low percentage of cases. Onions being raised almost exclusively from seed in Portugal, it is considered unlikely that the disease will become widespread, since the virus is perpetuated mainly through the bulbs.

D'OLIVEIRA (B.) & BORGES (MARIA DE L. V.). **Infecções perenais da Tranzschelia pruni-spinosae Pers. na Anemone coronaria.** [Perennial infections of *Tranzschelia pruni-spinosae* Pers. on *Anemone coronaria.*]—*Agron. lusit.*, iii, 1, pp. 71–77, 1941. [English summary.]

The writers' experiments, carried out in the greenhouse in Lisbon with material from Cambridge, England, showed that corms of *Anemone coronaria* infected by *Tranzschelia* [*Puccinia*] *pruni-spinosae* [*R.A.M.*, xxi, p. 243] when planted in the early autumn, gave rise to an abundance of leaves on which pycnidia, and later aecidia, developed from the end of March onwards. The mycelium perennating in the corms is consistently uninucleate, the binucleate phase being present in the aerial organs. Evidence of heterothallism is adduced from inoculation tests with spermatia of the rust, the development of which in nature appears to be governed by temperature conditions: in experiments on the treatment of the infected *Anemone* rhizomes by heat, a temperature of 34° C., maintained for four days, sufficed to kill *P. pruni-spinosae* without injuring its host.

OCFEMIA (G. O.), MACASPAC (I. S.), & YUAN (H. F.). **Experimental transmission of the mosaic of Canna indica.**—*Philipp. Agric.*, xxx, 5, pp. 357–370, 2 pl., 1942.

The mosaic disease of *Canna indica*, first observed in Davao, Philippine Islands, in 1937 [*R.A.M.*, xvii, p. 40], resembles that of abacá [*Musa textilis*], being characterized by the development on the leaves of irregular, pale yellow stripes running parallel with the veins and extending from the midrib to the margin. The affected foliage is more or less wrinkled and curled, and the chlorotic areas often turn rusty-brown. The stems, sepals, and petals may bear yellowish bands, while the fruit displays an indistinct mottling. The *Canna* virus is transmissible to *M. textilis* by *Aphis gossypii* and *A. maidis*, the former vector also being able to convey the mosaic from *C. indica* to *C. edulis* and to two ornamental *Canna* varieties. Neither *A. gossypii* nor *Rhopalosiphum nympheae* can, however, transmit abacá mosaic [ibid., xx, p. 465] to *C. edulis* and the horticultural varieties. *A. gossypii* can communicate *C. indica* mosaic to abacá seedlings after some five minutes' feeding on the former host, five individuals of the aphid sufficing to effect the transmission. Therefore, whether or not the virus is identical in the two hosts, mosaic-infected *C. indica* serves as a source of inoculum for infecting abacá with mosaic disease. A viruliferous *A. gossypii* loses all its virus while feeding on the first abacá plant, and an hour in a test-tube after feeding on mosaic *Canna* destroys its capacity to infect *M. textilis*. *A. laburni*, *Pentalonia nigronervosa*, and *R. nympheae* do not act as carriers of *Canna* mosaic.

TAKIMOTO (S.). **Bacterial leaf spot of Cissus japonica Wild.**—*Ann. phytopath. Soc. Japan*, ix, 1, pp. 41–43, 1 fig., 1939. [Japanese. Abs. in *Biol. Abstr.*, xvi, 6, p. 1454, 1942.]

*Aplanobacter cissicola*, causing a black leaf spot of *Cissus japonica*, is described [in English] as a non-motile, Gram-negative rod with rounded ends, occurring singly or in pairs, measuring 1 to 2 by 0·5 to 0·9 $\mu$, and forming capsules but not spores. On potato-extract agar the colonies are circular, convex, smooth, and dirty white. The organism produces slight clouding of beef bouillon, followed by precipitation of pellicle and rim. Gelatine is not liquefied, and milk is digested without coagulation. Good growth is made in Uschinsky's solution, with the formation of pellicle, green pigment, and increased viscidity. The organism is strictly aerobic, does not reduce nitrates, produces neither hydrogen sulphide nor indol, does not digest starch, or form acid or gas from sucrose, glucose, lactose, or glycerine. Salt toleration is 3 per cent., and the minimum, maximum, and optimum growth temperatures are, respectively, 10°, 35°, and 30° C., while the thermal death point is between 49° and 50°. It is pathogenic to *C. japonica* only.

Pape (H.). **Die Alternaria-Krankheit der Zinnie und ihre Bekämpfung. (Alternaria zinniae n.sp.).** [The *Alternaria* disease of the Zinnia and its control. (*Alternaria zinniae* n.sp.).]—*Angew. Bot.*, xxiv, 1 & 2, pp. 61–79, 6 figs., 1942.

During the past four or five years the writer has observed in various parts of Germany the development of the *Alternaria* disease of the *Zinnia* (chiefly *Z. elegans* and *Z. haageana*), which has been widely substituted by market-gardeners and horticulturists in general for the China aster in soils where the latter suffers from wilt [*Fusarium conglutinans* var. *callistephi*]. The fungus responsible for the trouble under observation does not appear to agree with the species of *Alternaria* previously recorded on the same host in the United States, Holland, and Denmark [*R.A.M.*, xvii, p. 96], or with *Macrosporium caudatum* from the last-named country [the U.S.S.R., and (?) England: ibid., ii, p. 488; vii, p. 787; xviii, p. 654]. The fungus in question is accordingly regarded as a new species and designated *Alternaria zinniae* n.sp. [without a Latin diagnosis]. It is characterized by [ob]clavate conidia of a faint yellowish-brown tinge (except for a hyaline, filiform, terminal cell measuring $1\frac{1}{2}$ times the length of the spore proper), with 3 to 12 transverse and 0 to 9 longitudinal, muriform septa (average 6 to 8 and 4 to 6 respectively), 75 to 253 by 14 to 27 (128 by 19) $\mu$, borne for the most part singly on 2- to 6-celled, brown conidiophores, 40 to 65 by 6 to 8 $\mu$, or terminally or laterally on branches of the mycelium.

The fungus forms on both leaf surfaces irregular, scattered, often somewhat serrated, dark brown, sometimes purplish-red-bordered, dry spots, 0·5 to 1·5 cm. in diameter, occupied in the centre or elsewhere by a whitish-grey patch, 1 mm. in diameter, in which the tissues are completely shrivelled and bleached. The lower, older leaves are the first to contract infection, which may, however, in severe cases extend to the younger foliage nearer the top of the plant, to the stems, and to the inflorescences, the labiate flowers of the last-named being covered with similar lesions to those observed on the laminae. This phase of the disease, which reaches a climax during the late summer, so disfigures the plants as to render them unfit for sale. *A. zinniae* is also the cause of a seedling rot of the damping-off type, frequently resulting in losses amounting to 40 to 60 per cent. of the stand. The cotyledonary leaves bear large, brown to black spots whence infection evidently spreads upwards to the lower, and ultimately to the upper foliage.

Samples of seed from three localities in Germany as well as from France and the United States were found to contain conidia of *A. zinniae,* 30 to 65 per cent. of which were germinable in tap water. Plants raised from these samples in the greenhouse at the Kiel branch of the Biological Institute (for diseases of ornamentals) in 1938 were largely infected by the disease under observation.

Inoculation experiments with aqueous spore suspensions of the fungus on wounded and unwounded *Zinnia* leaves gave positive results, whereas a number of other plants reacted negatively. On injured foliage the spread of infection was expedited and inoculations were successful under comparatively dry conditions. The development of *A. zinniae* was shown by pot tests to be promoted by an excess of nitrogen and a deficiency of potash. The conidia of the fungus were killed by 15 minutes' immersion in 0·125 per cent. fusariol, 0·125 per cent. germisan, and 0·25 per cent. uspulun, and by half an hour in 0·125 per cent. abavit, but all these preparations, with the exception of uspulun, reduced the viability of the seed by 30 per cent. and upwards. Where fungicidal treatment is to be carried out, therefore, extra quantities of seed should be provided to compensate for eventual losses. Cultural measures likely to contribute to the control of the disease include a sparing use of nitrogenous manure, a plentiful potash supply, the use of resistant varieties, e.g., Eldorado and Cherry Queen, thorough clearing of the beds and burning of refuse in the autumn, and a regular change of site.

Sprague (R.). **A revised check list of the parasitic fungi on cereals and other grasses in Oregon.**—*Plant Dis. Reptr, Suppl.* 134, pp. 1–36, 1942. [Mimeographed.]

This list of fungal diseases of cereals and grasses in Oregon combines the two similar lists already issued [*R.A.M.*, xvii, p. 380] and makes a number of additions to them. It includes 677 citations of fungi on separate hosts.

Sprague (R.). **An annotated list of the parasitic fungi on cereals and other grasses in Klickitat County, Washington.**—*Plant Dis. Reptr*, xx, 10, pp. 228–240, 1942. [Mimeographed.]

This list comprises 28 genera of fungi, including at least 73 recognized species and varieties, and a total of 191 host pathogen combinations, based on 327 collections from 53 Gramineae [cf. preceding abstract] made in the course of cereal disease investigations from 1929 to 1940 [cf. *R.A.M.*, x, p. 744], mostly along the Evergreen Highway from Bingen to Goldendale or in the neighbourhood of High Prairie, Washington.

Hardison (J. R.). **Grass diseases in Michigan in 1941.**—*Plant Dis. Reptr*, xxvi, 3, pp. 67–75, 1942. [Mimeographed.]

In the introduction to this list of diseases of grasses observed in Michigan in 1941, the author states that *Stagonospora bromi* caused a serious leaf, sheath, and stem spot of several species of *Bromus*, and was by far the most destructive disease found on brome grasses. It reached epidemic proportions, though previously seldom reported from the United States. *Darluca filum* [*R.A.M.*, xx, p. 570] was commonly present on *Puccinia coronata*, *P. graminis*, *P. montanensis*, *P. poae-sudeticae*, and *P. rubigo-vera*. With *P. graminis* the parasite appeared to cause notable reduction in rust development, and many cases of unusual leaf and stem spot symptoms were due to heavily parasitized stem rust infections, which in some instances were able to sporulate only very slightly or not at all. Powdery mildew (*Erysiphe graminis*) was very serious on *Poa palustris* in May and June, completely killing the current growth. Only slight recovery occurred during the autumn rains. *Piricularia grisea* [ibid., xvi, p. 195] and *Cercospora setariicola* together caused considerable defoliation of *Setaria lutescens*. The 'bends' disease [ibid., xx, p. 584] (cause undetermined) is reported for the first time on *B. arvensis*, *B. japonicus*, *B. mollis*, *B. secalinus* var. *velutinus*, *B. tectorum* var. *glabratus*, *Hordeum murinum*, *Poa pratensis*, and *Scleropoa rigida*.

Parker (D. L.). **A note on 'perennial' Prairie Grass.**—*J. Aust. Inst. agric. Sci.*, viii, 1, pp. 29–30, 1942.

Eight types of prairie grass (*Bromus unioloides*) from Australian and overseas sources were studied in South Australia under single-plant conditions and in grazed swards. Type VI gave the highest yields in grazing trials both at the Waite Research Institute, Adelaide (rainfall 22·5 in.), and on an irrigated reclaimed swamp at Murray Bridge, South Australia. All material of this type remained completely immune from attack by *Ustilago bromivora* [*R.A.M.*, xix, p. 156] which often reduces or prevents seed production in prairie grass. 'Perennial' prairie grass has been produced on a commercial scale in Tasmania for the past ten years, but it is not known whether it has remained free from contamination. The immunity from smut referred to applies strictly only to the six samples received at the Waite Institute.

**A new fungicide : thiosan.**—*Parks, Golf Courses, Spts Grnds*, vii, 11, p. 129, 1942.

This paper (an abstract from *Greenkeepers' Reptr, U.S.A.*) reports further successful results in turf nurseries and on 18 playing greens in Delaware and New Jersey in tests with tetramethyl thiuramdisulphide for the control of brown patch [*Corticium solani*] and dollar spot [*Sclerotinia homoeocarpa*] of Washington, Metropolitan,

Colonial, and Velvet bent grass [*Agrostis stolonifera*: *R.A.M.*, xxi, p. 383]. The new proprietary product, shortly to be placed on the market under the name of 'thiosan', was shown by comparative experiments to exert approximately the same fungicidal action as special semesan. Weekly applications of the sulphur compound for six weeks induced neither yellowing nor retardation of growth in the treated turf.

Colwell (W. E.) & Lincoln (C.). **A comparison of boron deficiency symptoms and Potato leafhopper injury on Alfalfa.**—*J. Amer. Soc. Agron.*, xxxiv, 6, pp. 495–498, 1 col. pl., 1 fig., 1942.

The results of greenhouse and field studies, the former at the Cornell Agricultural Experiment Station and the latter at two localities in north-central New York State, on the differences between boron deficiency symptoms and those of potato leafhopper (*Empoasca fabae*) on lucerne [*R.A.M.*, xxi, p. 143] indicated that one of the most valuable criteria of separation is the distribution of the yellowing or reddening, that due to the insect being uneven, while signs of boron starvation are confined to the terminals. A shortening of the terminal internode is constantly associated with boron deficiency but does not accompany even severe leafhopper injury, while another exclusive feature of boron deficiency is the death of the terminal bud. The type of yellowing alone is an insufficient means of differentiation, though the leafhopper discoloration tends to present a streaky appearance and often develops on the distal portion of the leaflet in the shape of a 'V'. Leafhopper reddening is inclined to assume a more purplish cast than that due to boron deficiency, severe cases of which are often characterized by a yellowing of the upper, and reddening of the under side of the leaf.

Sharvelle (E. G.). **The use of dinitro-ortho-cresol as an eradicant spray for fruit diseases.**—*Plant Dis. Reptr*, xxvi, 6, pp. 153–157, 1942. [Mimeographed.]

On 30th April, 1940, some rows of McIntosh apples in an orchard in Minnesota were treated against scab [*Venturia inaequalis*] by means of a thorough ground spray of 0·5 per cent. elgetol [*R.A.M.*, xxi, pp. 82, 130, 245]. The whole orchard was later given five applications (between 9th May and 9th August) of lime-sulphur. In 1941, the same ground area was again sprayed with elgetol and the entire orchard given five summer applications of Stauffer magnetic '70' sulphur paste. Also in 1941, part of a block of Cortland apples, which had not previously been sprayed, was treated with 0·5 per cent. elgetol, the whole block then receiving the five summer applications of Stauffer magnetic '70' sulphur paste.

The results obtained were as follows. In 1940, the McIntosh apples given both elgetol and lime-sulphur showed 4·1 per cent. scab, with average disease rating per fruit (determined on an arbitrary basis, according to the number of lesions) of 1·21, as against corresponding figures of 20·5 and 2·44 for the lime-sulphur treatment alone. In 1941, the McIntosh apples given elgetol and sulphur paste showed 4·1 per cent. scab, with average disease rating of 1·9, as against corresponding figures of 6 and 1·8 for the sulphur paste alone. The Cortland apples given elgetol and sulphur paste showed 27·6 per cent. scab, with average disease rating of 1·51, as against corresponding figures of 56·6 and 1·85 for the sulphur paste alone.

In 1941, 0·75 per cent. elgetol, applied as a delayed dormant spray to raspberries against *Elsinoe veneta*, was observed to be equally effective with 3–50 lime-sulphur, and its use is being considered by certain growers on grounds of economy.

Zagallo (A. C.). **Influência da temperatura no desenvolvimento e frutificação do Coryneum longistipitatum Berl. et Bres.** [The influence of temperature on the development and fructification of *Coryneum longistipitatum* Berl. & Bres.]—*Agron. lusit.*, iii, 2, pp. 121–127, 2 pl., 2 graphs, 1941. [German summary.]

The principal results of the author's laboratory studies on the influence of tem-

perature on the germination and development of *Coryneum longistipitatum*, a pathogen of stored apples in Portugal, have already been noticed from another source [*R.A.M.*, xxi, p. 243]. At the optimum temperature for conidial production of 12° C., the spores develop in dark chestnut-brown to black masses, whereas at 20° to 22° they are sparse and irregularly distributed, tending to collect in the centre of the colony. At 24° to 27°, cultures remaining sterile in darkness or subdued light may be stimulated to sporulation by the action of sunlight. The colour of the mycelium gradually changes from white with a chestnut tinge between 7° and 15° to pale pink at 27°, nearing the maximum for its development.

Osterwalder (A.). **Von der Fettfleckenkrankheit der Kirschen.** [On the Cherry grease spot disease.]—*Schweiz. Z. Obst- u. Weinb.*, li, 15, pp. 309–311, 9 figs., 1942.

Lauerzer or Rigi cherries in the canton of Schwyz [Lake of Lucerne] have been observed since 1936 to suffer from an olive-green grease spot disease resembling that produced on beans [*Phaseolus vulgaris*] in the same district by a bacterium [*Pseudomonas medicaginis* var. *phaseolicola*], though it is improbable that the same organism is implicated in both cases. Bacteria of some description, however, swarm in the diseased tissues and were experimentally shown to be responsible for the cherry trouble, which in its final stages of blackening and desiccation resembles, and is liable to confusion with, the shot-hole disease [*Clasterosporium carpophilum*]. The pathogen apparently penetrates through the scar left by the style on the site of its insertion on the ovary, where the single lesion normally found on each fruit most commonly develops, though lateral infections may also take place through insect wounds. Control by direct measures appears to offer little prospect of success, since the grease spot is prevalent on 'blue'- and lime-sulphur-sprayed trees.

Hildebrand (E. M.). **Tomato ringspot on Currant.**—*Amer. J. Bot.*, xxix, 5, pp. 362–366, 4 figs., 1942.

Symptoms, hitherto undescribed on currants, were observed in 1940 on plants grown at 70° to 80° F. in the greenhouse at the Rockefeller Institute, Princeton, New Jersey, and identified as caused by the virus of tomato ring spot [*R.A.M.*, xix, p. 668]. The virus isolated from these plants was transmitted by the rubbing method (with or without carborundum powder) to Turkish tobacco and *Nicotiana rustica*, which both showed abundant lesions, and in a limited way to *N. glutinosa* and China aster. Attempts to transmit the virus from tobacco back to currant by mechanical means were unsuccessful, whereas sap transmission from tobacco to tobacco and from the various susceptible hosts back to tobacco was readily achieved by the rubbing technique, the symptoms produced on Turkish tobacco being similar to those of tomato ring spot; similar to, but distinct from, those of tobacco ring spot; and distinct from those of tomato ring spot described by Imle and Samson [ibid., xvi, p. 501]. Young plants were found generally more susceptible than older ones. The host range of the virus agreed closely with that of tomato ring spot, 29 species belonging to 20 families picked at random from the list of its hosts (given by Price [ibid., xix, p. 668]) being found susceptible. Inoculation with the virus from currant produced typical symptoms in plants immunized against tobacco ring spot, but not in those immunized against the tomato ring spot virus, indicating a near relationship to the latter. A close agreement was also found to exist between the two viruses as regards incubation period, thermal inactivation, longevity *in vitro*, filterability, and dilution end point, but the virus from currant appeared to be the more virulent of the two. It is concluded that the currant virus is a strain of tomato ring spot virus. The fact that the virus isolated from mosaic diseased currant plants induced tomato ring spot symptoms in some cases, but not in others, is taken to indicate that two distinct diseases are involved, which may sometimes occur together.

Waldo (G. F.). **The Brightmore Strawberry.**—*Circ. Ore. agric. Exp. Sta.*, 263, 3 pp., 1942. [Mimeographed.]

The Brightmore strawberry variety, which is being widely grown in the Pacific Northwest, and is recommended for trial particularly in those areas where the Marshall variety cannot profitably be grown, has so far shown no sign of susceptibility to crinkle or yellows [xanthosis: *R.A.M.*, xxi, p. 340]; it is, however, susceptible to red stele (*Phytophthora fragariae*) [loc. cit.].

Wilcox (R. B.). **Blueberry stunt, a virus disease.**—*Plant Dis. Reptr*, xxvi, 9, pp. 221–213, 1942. [Mimeographed.]

Swamp or high-bush blueberries (*Vaccinium australe* Small) in New Jersey have for some years been affected by a disease known locally as 'stunt', apparently of virus origin. The general effect is a reduction in the length and vigour of new growth, a moderate stimulation of branching, and the production of small, unmarketable fruit. When affected bushes are severely pruned back they form numerous weak shoots which by midsummer tend to show cessation of terminal growth and develop branches near the tip at sharp angles with the stem. On newly infected vigorous bushes the new shoots may be 3 ft. high, but in advanced stages they are not more than half this, and sometimes grow only a few inches. Individual shoots on diseased bushes may die during their first winter, but the bush itself may survive for some years. From two to five of the youngest leaves of an infected basal shoot are usually pale green or yellowish at the tip and on the margins, especially in the distal half. Less frequently, the young leaves appear almost completely etiolated. No foliage mottling is present. All the leaves are reduced in size, and the internodes are shortened.

On mature, fruiting canes few large branches are produced, but there are usually many fruiting laterals, which are short and slender and bear crowded leaves. Fruit buds are formed except in the most advanced cases, but the berries, while they colour normally, remain very small, have an unpleasant taste, do not readily separate from the stems, and may remain on the bush after the leaves have fallen in autumn. The foliage of mature canes on stunted bushes of most varieties by midsummer assumes a brilliant orange-red hue which persists until the leaves drop. This coloration develops in two longitudinal, indefinitely limited stripes at or just inside the margin, the central portion of the leaf, including the base and, usually, the tip, remaining green. In advanced infections, the leaf margins may become necrotic and brown, with the two parallel red stripes closer to the midrib.

The disease has not been observed on the Rancocas variety; it occurs most commonly on Cabot, Concord, Pioneer, Rubel (which does not show the red discoloration), and Scammell. It was first noted in New Jersey and has since been recorded from North Carolina and New York State. Nursery stock has not shown the disease so far, and the youngest field to show severe infection was eight years old.

The method of dissemination in the field is not yet known, but it is suspected that some insect not commonly present may be the vector. Affected bushes should be pulled up, and plants from affected fields should not be used for propagation.

Cabral (R. V. de G.). **Notas sôbre o Gloeosporium olivarum Alm.** [Notes on *Gloeosporium olivarum* Alm.]—*Agron. lusit.*, iii, 1, pp. 49–58, 2 pl., 2 graphs, 1941. [English summary.]

The destructive olive disease caused by *Gloeosporium olivarum* is widespread in Portugal [*R.A.M.*, xxi, p. 243], some varieties showing up to nearly 100 per cent. infection. The fungus affects only mature fruits, which become covered with the minute orange to brown acervuli of the fungus, later wrinkling and dropping. The attacks develop severely after the first rains in October or November. Pure cultures of the pathogen were readily obtained on Dox's agar from material gathered five months earlier and maintained at room temperature in the laboratory. Inoculations

by spraying and by pricking on the fruits of both cultivated and wild olive trees were uniformly successful, but only negative results were obtained on other parts. The incubation period was shorter on mature olive fruits than on those less ripe. The optimum temperature for growth of the fungus was found to be 26° C., but spore production was abundant at 22°, 24°, 26°, and 27°.

SHAW (E. B.). **Banana migration and sigatoka.**—*J. Geogr., N.Y.*, xl, 9, pp. 350–354, 1941. [Abs. in *Biol. Abstr.*, xvi, 6, p. 1453, 1942.]

There has been a progressive migration of banana production from east to west in Central America, partly owing to the presence of sigatoka disease (*Cercospora musae*) [*R.A.M.*, xix, p. 551; xx, pp. 125, 265] in the eastern parts, and partly owing to the fact that the western parts are drier, healthier, favourably situated for irrigation, and less subject to hurricanes than the eastern ones. The expense of piping for spraying against the disease is about the same as the initial per acre expense and is too heavy for many small independent owners.

RHOADS (A. S.). **Notes on Clitocybe root rot of Bananas and other plants in Florida.**—*Phytopathology*, xxxii, 6, pp. 487–496, 3 figs., 1942.

Attention has already been drawn to the ravages of the mushroom or toadstool root rot of bananas [*R.A.M.*, xi, p. 382] and other plants [ibid., xx, p. 562] in Florida caused by *Clitocybe tabescens*, the symptoms of which on the first-named host agree closely with those of the corm rot reported from New South Wales [ibid., xv, p. 238]. Other hosts of the fungus in Florida, besides grapefruit and peach [ibid., x, p. 99; xx, p. 562], include apple, plum, guava, Mexican guava (*Psidium molle*), Java plum (*Eugenia jambolana*), rose apple (*E. jambos*), cherimoya (*Annona cherimola*), soursop (*A. muricata*), *Litchi chinensis*, sapodilla (*Achras sapota*), *Jatropha curcas*, *Cecropia palmata*, Catalonian jasmine (*Jasminum grandiflorum*), Carolina laurel-cherry (*Laurocerasus caroliniana*), *Dombeya punctata*, Woodland Margaret rose, and *Hibiscus rosa-sinensis*.

HADORN (C.). **Rationierung der Kupferspritzmittel in der Landwirtschaft.** [Rationing of copper spraying materials in agriculture.]—*Schweiz. Z. Obst- u. Weinb.*, li, 8, pp. 178–180, 1942.

Copper compounds in the form of fungicidal solutions are estimated to have saved Switzerland enormous losses from plant diseases during the past several decades, preventing, for instance, crop reductions of 30 to 50 per cent. from potato and tomato blight [*Phytophthora infestans*] and of 50 to 60 per cent. from celery leaf spot [*Septoria apii*]. In the absence of prophylactic treatment, moreover, anthracnose [*Colletotrichum lindemuthianum*] and rust [*Uromyces appendiculatus*] decimate the bean [*Phaseolus vulgaris*] crop, while vine downy mildew [*Plasmopara viticola*] is so prevalent that the grape harvest would be a total failure without spraying. The normal Swiss copper requirements for spraying in 1942 would have amounted to 1,550 tons of metal, but the war situation has necessitated the reduction of this quantity to 690 tons, of which 300 tons are allocated for the potato crop; 12·5 tons for beans, tomatoes, celery, and onions; a maximum of 50 tons for orchards; 320 tons for viticulture [cf. ibid., xxi, p. 439]; and finally, a reserve of 25 tons in case of emergency.

PARKER-RHODES (A. F.). **The fungicidal action of copper and sulphur.**—*Rep. Agric. Hort. Res. Sta., Bristol, 1941*, pp. 83–85, [1942].

This is an abbreviated account of the author's researches already noticed from other sources [*R.A.M.*, xxi, pp. 150, 422].

GOLDSWORTHY (M. C.), CARTER (R. H.), & GREEN (E. L.). **The fungicidal and phytocidal properties of some copper xanthates.**—*Phytopathology*, 6, pp. 497–504, 1942.

Saturated solutions of copper xanthates contain very little available copper, and

this element appears to be so tightly combined with sulphur that the compounds are non-injurious to sprayed plants. In laboratory perfusion tests [*R.A.M.*, xvii, p. 541] all of five copper xanthates were more or less toxic to the conidia of *Sclerotinia fructicola*, the most effective being those prepared from ethyl and butyl alcohols, whereas the spores of *Glomerella cingulata* proved resistant to their action, which in the case of both pathogens was of the same order as that exerted by a solution containing 0·50 p.p.m. of copper. Spray residues containing the ethyl and isoamyl xanthates were toxic to the conidia of *S. fructicola*, but not those of *G. cingulata.* Data from further tests indicated that the residues from copper xanthate mixtures are not as potent as those of Bordeaux mixture.

In orchard experiments at the United States Horticultural Station, Beltsville, Maryland, on five-year-old Williams' Early Red, York Imperial, Rome Beauty, and Starking Delicious apple trees infected with scab (*Venturia inaequalis*), the protection conferred by the copper ethyl and isoamyl xanthates (2 lb. of either to 4 of hydrated lime, 2 of bentonite, and 100 gals. water) was not equal to that afforded by the standard schedule of early lime-sulphur and late copper phosphate sprays, though they did reduce the incidence of infection to a very considerable extent, especially in York Imperial.

Under greenhouse conditions the xanthates caused no injury to Red Kidney beans (*Phaseolus vulgaris*) and Starking Delicious apple foliage at high or low humidities and average temperature, but in the above-mentioned orchard trials on apples in 1937, the copper ethyl and isoamyl xanthates appeared to favour the development of arsenical injury when lead arsenate was included in the spray combination.

Partansky (A. M.). **Field testing of mold resistant properties of interior oil paints.**—*Industr. Engng Chem.*, Analyt. Ed., xiv, 7, pp. 527–531, 6 figs., 1942.

The results of field tests on the mould-resistant properties of interior oil paints at various industrial plants in the mid-western and eastern States of the American Union confirmed those of previous laboratory experiments [*R.A.M.*, xix, p. 719] as to the preservative efficacy of tetrachlorophenol and zinc tetrachlorophenate, both of which, at a concentration of 3 per cent., maintained an oil and a cold-cut resin type of paint in a sound condition for two years.

Linn (M. B.). **A method of mounting cultures of fungi for preservation in the herbarium.**—*Phytopathology*, xxxii, 6, pp. 546–547, 1942.

Celluloid, washed, rinsed, dried, and cut into squares slightly larger than a Petri dish, has been found superior as a mounting base for fungal cultures to paper or other materials previously utilized for this purpose. The agar medium (2 per cent. potato dextrose in the author's tests) is lifted from the dish with a spatula, laid in the centre of the celluloid square, and left to dry for three days at 20° to 25° C., under which conditions it becomes firmly attached to its base.

Brooks (F. T.). **Disease-resistant plants.**—*Endeavour*, i, 3, pp. 114–117, 3 figs., 1942.

The author traces the history of plant hybridization from the early pioneer work in the nineteenth century to modern breeding of plant varieties resistant to disease based on Mendel's law of heredity. Special mention is made of attempts to breed disease-resistant varieties of wheat, potato, tomato, fruit trees, and of tropical crops such as sugar-cane, banana, and cacao.

Pinckard (J. A.). **The mechanism of spore dispersal in Peronospora tabacina and certain other downy mildew fungi.**—*Phytopathology*, xxxii, 6, pp. 505–511, 2 figs., 1942.

In studies at the Virginia Agricultural Experiment Station, sporangial dispersal in the agent of tobacco downy mildew, *Peronospora tabacina* [*R.A.M.*, xix, p. 439],

*P. parasitica* on *Lepidium virginicum*, *P. geranii* on *Geranium carolinianum*, and *P.* [*Plasmopara*] *halstedi* on *Ambrosia* spp. was observed to begin with incipient desiccation and conclude with hygroscopic distortion of the aerial fructifications. Several complete twists occur in the portion of tall sporangiophores extending up to the first branch, with a lesser number between each successively shorter branch. With the progress of drying, a twisting and bending motion is imparted to the sterigma-like structure on which the sporangia are borne. On the discontinuance of desiccation the movement ceases, and with an access of humidity the rotation reverses itself. Under conditions of delicate moisture balance the breath of the observer suffices to induce the above-mentioned movements, the outcome of which is the release of the mature sporangia. The ejection of mature sporangia was experimentally shown not to be dependent upon entanglement. By slowly decreasing the vapour pressure a point was reached when abcission occurred, the sporangium apparently being forcibly released, the stimulus for the requisite energy being derived from differential stresses set up within the sterigmata. C. J. Nusbaum *in litt.* describes a similar hygroscopic mechanism in *Peronospora parasitica* on cabbage and *P. effusa* on *Chenopodium album*. The mechanical action of wind and rain, during periods of atmospheric saturation, does not appear to contribute significantly to sporangial dispersal in the downy mildews under observation.

Hofmeyr (J. H.). **Inspection of Potato fields for seed Potatoes.**—*Fmg S.Afr.*, xvii, 196, pp. 439–440, 1942.

Details are given of the potato inspection scheme which has been functioning for about a year in South Africa. The inspection, which covers virus and other diseases and eelworm infestation, is being extended to individual farmers outside seed potato-growers' associations.

Folsom (D.). **Potato virus disease studies with tuber-line seed plots and insects in Maine 1927 to 1938.**—*Bull. Me agric. Exp. Sta.* 410, pp. 215–250, 4 pl., 1 map, 1942.

In field work conducted from 1927 to 1932 at Highmoor Farm, south-western Maine, 21 tuber-line seed plots were invaded in 15 out of 75 exposures by one or another of the virus diseases present on potatoes in fields situated not less than ¼ mile away (e.g., mild and rugose mosaic, leaf roll, spindle tuber, and yellow top [*R.A.M.*, xxi, p. 322]). The results of regular inspections of 114 tuber-line seed plots grown from 1933 to 1938 on 74 different farms (mostly with seed from Highmoor Farm seed plots, planted under an aster-cloth cage which excludes virus diseases perfectly) showed that mosaic (mostly mild) invaded 43 plots out of 83, leaf roll 17 out of 39, yellow top 3 out of 108, and spindle tuber 1 out of 109. The average proximity to diseased fields was much greater for the plots invaded by mosaic and leaf roll than for those not invaded, but the amount of disease in the invaded plots was not indicated reliably by the degree of proximity. The farmers' seed plots were invaded by mosaic and leaf roll in varying degree according to seasonal and other factors. Thus, in 1937, the incidence of leaf roll was unusually high in all counties, while that of mosaic increased in some and decreased in others. Both diseases usually increased in spite of roguing or appeared where they were absent before, while spindle tuber decreased when present and yellow top mostly disappeared altogether. It was found that the further north and east in the State the seed plot was planted, the more likely would be an increase in mosaic and the less likely one in leaf roll. Mosaic increase was correlated significantly with that of leaf roll in two years, but not in the other three. The certification proximity rule was found not a safe guide as to the amount of disease invading healthy plots. Insect counts and root contact tests showed that leaf roll was transmitted by two aphids, *Macrosiphum solanifolii* and

*Aphis abbreviata*, but not by *Epitrix cucumeris*, *Leptinotarsa decemlineata*, *Empoasca mali*, or *Lygus pratensis*, and not by root contact in the soil.

Söding (H.). **Über den Wuchsstoffhaushalt abbaukranker Kartoffeln.** [On the auxin economy of 'degenerate' Potatoes.]—*Angew. Bot.*, xxiv, 1–2, pp. 114–117, 1942.

In further studies on the relationship of the auxin content of potatoes to 'degeneration' [*R.A.M.*, xix, p. 298], diseased plants were found not only to be poorer in growth substances than healthy ones, but also to respond much less actively to the application of heteroauxin solutions to the leaf rachis. The deep-seated changes in the growth system of the plant thus expressed probably represent a 'vicious circle', in which a reduction of the auxin content brings about a loss of plasticity, the latter entailing weakness of reaction to the stimulus of growth substances and the whole series of pathological modifications culminating in under-development and probably in a lowered capacity for auxin formation. By means of Funke's highly sensitive 'coleoptile test' (*Jb. wiss. Bot.*, lxxxviii, p. 373, 1939) it was possible to determine the effect on the auxin content of the tubers of different viruses, of which leaf roll was markedly instrumental in destroying the growth substances, though the action of various types of mosaic and of the X and A viruses could also be traced. Observations (as yet unpublished) point to the simultaneous existence in the potato tuber of auxins and substances inhibiting their functions.

Stapp (C.). **Serologischer Nachweis von X-, Y- und A-Virus der Kartoffeln. Vorläufige Mitteilung.** [The serological diagnosis of the X-, Y-, and A-viruses of Potatoes. Preliminary note.]—*Zbl. Bakt.*, Abt. 2, cv, 7–9, pp. 127–128, 1942.

By means of intravenous injections into rabbits of potato juices infected by the X, Y, and A viruses, the writer, using first the precipitin-ring method for X, Chester's field technique [*R.A.M.*, xxi, p. 425] for Y, later Pfankuch and Kausche's method [ibid., xvii, p. 764] for X, and an as yet unpublished modification of the same for Y and A, secured antisera reacting specifically towards these viruses, both singly and in combination.

Köhler (E.). **Untersuchungen über das 'K'-Virus der Kartoffel. 1. Mittlg.** [Studies on the 'K' virus of the Potato. Note 1.]—*Angew. Bot.*, xxiv, 1–2, pp. 118–130, 3 figs., 1942.

The salient features of the aphid- and graft-transmissible 'K' virus of potatoes, isolated by the writer in 1940 from samples of diverse origin planted at the Biological Institute, Dahlem, Berlin, in the previous autumn, have already been described from another source [*R.A.M.*, xx, p. 486]. In the present expanded and tabulated account the opinion is expressed that the newly identified virus is in all probability identical with Dykstra's 'E' (leaf-rolling mosaic) [ibid., xix, p. 337], though the available data do not at the moment suffice for the complete establishment of this hypothesis.

Kreutzer (W. A.) & McLean (J. G.). **First report of late blight of Potato in Colorado.**—*Plant Dis. Reptr*, xxvi, 4, p. 91, 1942. [Mimeographed.]

During 1941 *Phytophthora infestans* was found on potatoes in the irrigated section of northern Colorado, this being, apparently, the first record for the State. Infection was first observed in storage. Of 20 cellars where infected lots were found, most showed a trace to 0·5 per cent. of the disease; one seed lot contained 1 per cent. infected material, and two showed nearly 25 per cent., the tubers in the last two cases being grown from seed obtained from the Lake States region. Weather conditions during the growing season in Colorado do not, as a rule, favour *P. infestans*, but in 1941 rainfall was above normal, and many cloudy or partially cloudy days were experienced, frequently accompanied by light rainfall and lowered temperatures. Precautions are being taken against the use of infected seed.

Müller (K. O.) & Griesinger (R.). **Der Einfluss der Temperatur auf die Reaktion von anfälligen und resistenten Kartoffelsorten gegenüber Phytophthora infestans.** [The influence of temperature on the reaction of susceptible and resistant Potato varieties to *Phytophthora infestans*.]—*Angew. Bot.*, xxiv, 1–2, pp. 130–149, 5 graphs, 1942.

In further studies on the physiological and genetical bases of resistance in the potato to late blight (*Phytophthora infestans*) [*R.A.M.*, xxi, p. 217], the minimum, optimum, and maximum temperatures for the development of the fungus on the tubers were found to be just under 5°, 19° to 20°, and 25° to 26° C., respectively. In the resistant varieties BRA 5/31 and BRA 9/31, the defensive reaction sets in between 5° and 11°, the speed of the process increasing as the temperature rises; another slight access of velocity occurs within the range of 21° to 25°. Defensive necrosis is intensified at low temperatures. A defensive reaction also takes place in the susceptible Erdgold, but its progress is too slow, in comparison with the rapidity of development of the pathogen, to bring the latter to a standstill and premature death. In the various temperature ranges mycelial production on Erdgold tubers increased in luxuriance with the time interval between the appearance of the first aerial hyphae and the preliminary indications of necrotic changes. It is concluded from the data at hand that the extent of mycelial growth is a result of the interaction of two factors—vitality of the fungus on the one hand, and rapidity of response of the tuber to infection on the other. The sporangia of *P. infestans*, introduced into the tuber through wounds, retain their infectivity for at least a month. Resistance tests on tubers are best conducted at a temperature range of 16·5° to 21°.

Szirmai (J.). **Ein sonderbarer Fall des Auftretens von Rhizoctonia solani auf der Kartoffel in Mieten.** [A remarkable case of the occurrence of *Rhizoctonia solani* on the Potato in pits.]—*Mezőgazdas. kutatás.*, xiv, pp. 291–295, 1941. [Hungarian, with German summary. Abs. in *Chem. Zbl.*, cxiii (ii), 2, p. 229, 1942.]

Potato tubers stored in sand for the winter were found on examination at the Agricultural Research Institute, Nagybakta, Hungary, to be infected by *Rhizoctonia* [*Corticium*] *solani*, which had entered by way of the lenticels, penetrating the tissues to a depth of 1 cm. and causing up to 100 per cent. damage. It was found that the sand in the affected pits had not been renewed for four years, and its replacement by a fresh load resulted in a reduction of the injury to between 2 and 4 per cent.

Boewe (G. H.). **Charcoal rot on Potatoes in Illinois.**—*Plant Dis. Reptr*, xxvi, 6, pp. 142–143, 1942. [Mimeographed.]

On 1st July, 1941, potato plants near East St. Louis, Illinois, were found to be affected by *Rhizoctonia bataticola* [*Macrophomina phaseoli*], this being the first record of the fungus on potato in the State [*R.A.M.*, vii, p. 53; xix, p. 254]. All the potato fields visited in this locality (Madison and Monroe counties) contained affected plants; the disease was also present in La Salle county. In affected fields in which counts were made diseased hills averaged 19·7 per cent. The sclerotia ranged from 49·8 to 106·2 by 43 to 83 (average of 100, 77·4 by 66·1) $\mu$.

List (G. M.) & Kreutzer (W. A.). **Transmission of the causal agent of the ring-rot disease of Potatoes by insects.**—*J. econ. Ent.*, xxxv, 3, pp. 455–456, 1942.

Provisionally accepting as evidence of transmission the migration of the ring rot organism (*Phytomonas sepedonica*) [*Corynebacterium sepedonicum*] from the point of feeding on the foliage of caged potato plants raised from disease-free seed, the writers, in a preliminary test at the Colorado Agricultural Experiment Station, implicated the potato beetle (*Leptinotarsa decemlineata* Say), grasshoppers (*Melanoplus differentialis* Thomas), and the black blister beetle (*Epicauta pennsylvanica* De Geer) as

vectors of the disease, though not necessarily constituting an important factor in field spread.

Goss (R. W.), Leach (J. G.), & Dykstra (T. P.). **Committee report on ring rot of Potatoes in 1941.**—*Plant Dis. Reptr*, xxvi, 8, pp. 197–198, 1942. [Mimeographed.]

In this report of the Committee appointed by the American Potato Association to stimulate and co-ordinate research into potato ring rot (*Phytomonas sepedonica*) [*Corynebacterium sepedonicum*: *R.A.M.*, xxi, pp. 301, 322], it is stated that a survey made in the United States during 1941 showed that in 17 States the disease was less prevalent than in 1940, while in eight it was more widespread. In one State 33 per cent. of the carload lots dispatched in 1940 contained infected potatoes, whereas in 1941 only 6 per cent. were affected. In another State the losses in the two years before 1941 in one county alone amounted to $200,000, whereas in 1941, with greater care in handling the seed, the loss did not exceed $10,000. Most States attributed the decreased infection of 1941 to the publicity given to control, and to the cheapness of certified seed. The outlook is good, provided the certifying agencies in the seed-producing States keep up close control.

It is recommended that, in addition to field inspection, at least four 25 lb. random samples for each 1,000 bush. stored should be examined (by the inspector) by cutting every tuber. Suspected tubers should be examined under fluorescent light, or smears should be made and examined under a microscope. The bin inspection should be conducted as late in winter as possible.

Cralley (E. M.) & Adair (C. R.). **Rice blast in Arkansas.**—*Plant Dis. Reptr*, xxvi, 6, pp. 149–150, 1942. [Mimeographed.]

Rice blast (*Piricularia oryzae*) [*R.A.M.*, xxi, pp. 96, 160] has caused serious losses in those parts of Arkansas that have recently been brought into rice production. The disease decreases in importance as the land is cropped to rice, and seldom causes severe damage after three or four crops have been grown. Minor losses have occurred in old rice fields previously out of rice production for some years. The tabulated results of resistance tests on 29 varieties or hybrids in 1940 and 1941 showed that Early Prolific, a variety commonly grown on new land, is very susceptible, while Zenith and Arkansas Fortuna, which generally outyield Early Prolific and command better prices, are resistant. The high-yielding hybrid selections, Arkrose and Prelude, appear to be moderately resistant.

Bottcher (Elizabeth J.) & Conn (H. J.). **A medium for the rapid cultivation of soil Actinomycetes.**—*J. Bact.*, xliv, 1, p. 136, 1942.

At the New York (Geneva) Agricultural Experiment Station the authors have obtained rapid growth of eleven cultures of soil Actinomycetes on a medium consisting of cotton soaked in 5 ml. glycerol, 2 gm. yeast extract, 1 gm. potassium nitrate, and 1,000 ml. water.

Pozdena (L.) & Bartram (H.). **Komplexbedingte Bodenkrankheiten.** [Soil diseases of complex origin.]—*Bodenk. PflErnähr.*, xvii, pp. 33–35, 1940. [Abs. in *Zbl. Bakt.*, Abt. 2, ciii, 18–20, p. 366, 1940.]

The examination of soil profiles in the Warthe and Oder marshes to ascertain the reason for the failure of liberally manured crops pointed to physical causes as the chief etiological factor, to which the observed biological abnormalities are subsidiary. The latter were characterized by an erratic instead of a steady decrease in the microflora of the deeper soil layers, and by a preponderance of Actinomycetes at nearly every depth investigated, especially in iron-containing soils. Pure-culture studies showed that development and sporulation in this group of fungi is markedly stimulated by

iron, the presence of which may even counteract other conditions adverse to their growth, such as deficiency of organic materials.

KERR (W. H.). **Bureau of Sugar Experiment Stations.**—*Aust. Sug. J.*, xxxiv, 4, pp. 153–155, 1942.

The following restrictions are imposed by Proclamation No. 13, issued under the Sugar Experiment Stations Acts, on the whole of the Moreton Mill (Queensland) area. 1. No sugar-cane of any variety may be removed from any farm which has been infected with Fiji disease [*R.A.M.*, xxi, p. 305] during the past three years, or from one part of any such farm to another, without a written permit from the Moreton Cane Pest and Disease Control Board for such transfer. This does not apply to cane sent to the mill for crushing, but precludes the use by a grower of plants from a diseased farm. 2. On any farm on which Fiji disease is, or has been present within the last three years, no cane of the P.O.J. 2878 variety may be further ratooned if planted in or before 1939. An owner of a Fiji-diseased farm, wishing to carry on to 1943 any cane of this variety dating from or before 1939 must apply for a permit to do so. 3. The Moreton Central Sugar Mill is prohibited under penalty from crushing P.O.J. 2878 from diseased farms for which no permit has been granted for cultivation beyond the fourth calendar year of growth.

The spread of Fiji disease during the late summer and autumn of 1941 was well above normal, owing to favourable conditions for the activity of the sugar-cane leaf-hopper [*Perkinsiella saccharicida*], especially in parts of the Bundaberg and Moreton areas, but the repeated inspections conducted by the Cane Pest and Disease Control Boards [ibid., xxi, p. 44], combined with the dry conditions prevailing early in the current year, are expected to restore the situation before next season. In the Maryborough district a striking improvement has been effected by the non-approval of susceptible varieties in severely infested areas.

Downy mildew [*Sclerospora sacchari*: ibid., xxi, pp. 304, 347] has been kept well under control at Bundaberg, but continuous vigilance is essential since the disease is of a type liable to 'flare up' without warning. Infection would by now have been practically eliminated from Mackay but for the ill-advised retention by certain growers of small patches of non-approved, susceptible varieties, thereby postponing the time for the safe reintroduction of P.O.J. The position is well in hand in the Cairns and Mossman districts, where small outbreaks of downy mildew have been cleaned up.

BENNETT (C. W.). **Informe sobre experimentos con el mosaico de la Caña de Azúcar en Tucumán, Argentina. Octubre 12 de 1940 a febrero 9 de 1941.** [Report on experiments with Sugar-Cane mosaic in Tucumán, Argentine, from 12th October, 1940, to 9th February, 1941.]—*Rev. industr. agríc. Tucumán*, xxxi, 10–12, pp. 427–437, 1941.

A detailed, tabulated account is given of a series of nine inoculation experiments (by sap transmission) on four sugar-cane varieties C[anal] P[oint] 28/60, C.P. 31/294, C.P. 31/588, and C.P. 29/291, with the mosaic virus from P.O.J. 213, 2727, and 36 (including strains of the last-named from the provinces of Tucumán and Jujuy), Bourbon, Louisiana Striped, Tuc. 472, and a Portuguese East African selection designated Co. 4x, from the results of which it would appear that the symptoms induced by the inoculation from all sources corresponded in the main to those of the United States type 2 [*R.A.M.*, xviii, pp. 621, 622]. They included stunting, mottling, marginal and apical necrosis in C.P. 28/60 and 31/294, chlorotic foliar lesions attaining a diameter of up to several centimetres, with localized reddening of their centres and edges, and limited superficial necrosis in 31/588, and very mild, generalized mottling in 29/291. Out of 25 plants of C.P. 28/60 inoculated 15 contracted infection, the

corresponding figures for 31/294, 31/588, and 29/291 being 15 out of 33, 13 out of 33, and 10 out of 19, respectively.

Seaver (F. J.). **Photographs and descriptions of cup-fungi. XXXVI. A new species and genus.**—*Mycologia*, xxxiv, 3, pp. 298–301, 1 fig., 1942.

After referring to the fact that Dr. L. Bonar of California has proved by cultures that the ascospores of *Dermatea brunneo-pruinosa*, described by Zeller (*Mycologia*, xxvi, p. 291, 1934) on leaves of *Gaultheria shallon* on spots associated with *Pestalotia gibbosa* do in fact on germination produce the conidial or *Pestalotia* stage, the author states that in 1938 he received *Rhododendron maximum* leaves showing spots bearing a *Pestalotia* stage and an apothecial stage so similar to that described by Zeller that they were at first considered to be identical. The connexion between the *Pestalotia* and the associated Ascomycete on rhododendron is assumed to exist; as the conidial stages of the two fungi appear to be distinct, the perfect stages are, for the present, also assumed to be distinct.

The name *Pestalopezia* n. gen. is proposed for those species of cup fungi which have a *Pestalotia* as their conidial stage; type species, *Dermatea brunneo-pruinosa*, which would become *Pestalopezia brunneo-pruinosa* (Zeller) Seaver, comb. nov. The rhododendron fungus is named *Pestalopezia rhododendri* n. sp.

Murrill (W. A.). **New fungi from Florida.**—*Lloydia*, v, 2, pp. 136–157, 1942.

Latin and English diagnoses are given of 52 new species and one new variety of fungi from Florida, the new variety being *Rigidoporus surinamensis subauberianus*, found on the base of a living laurel oak [*Quercus laurifolia*] and apparently intermediate between *R. surinamensis* and *Fomes auberianus*. It is characterized by a sessile, subdimidiate, imbricate, cremeous to badious pileus measuring about 6 by 9 by 1 cm., and globose spores 3 to 4 $\mu$ in diameter.

Da Camara (E. de S.) & Da Luz (C. G.). **Mycetes aliquot Lusitaniae IV.** [Some fungi of Portugal IV.]—*Agron. lusit.*, iii, 1, pp. 25–46, 8 figs., 1941.

This further instalment of the authors' critically annotated list of Portuguese fungi [*R.A.M.*, xix, p. 365] brings the total number so far recorded to 234, two species, two varieties, and one form in the present series being new to science and 36 additions to the mycoflora of the country. *Pleosphaerulina briosiana* n. var. *macrospora* was collected on the leaves of crimson clover (*Trifolium incarnatum*), *Sphaeropsis malorum* [*Physalospora obtusa*] on pear fruits, and *Gloeosporium mangiferae* [*Glomerella cingulata*] on mango fruits (in the Lisbon market).

Da Camara (E. de S.), D'Oliveira (A. L. B.), & Da Luz (C. G.). **Uredales aliquot Lusitaniae I (continuatio). II.** [Some rusts of Portugal I (continuation). II.]—*Agron. lusit.*, ii, 2, pp. 113–167; 4, pp. 338–377, 1940.

These two further instalments of the authors' critically annotated catalogue of Portuguese rusts [*R.A.M.*, xx, p. 136] bring the total number of species on record for the country to 95. A six-page bibliography and a host index are appended to the second paper.

Mundkur (B. B.) & Kheswalla (K. F.). **Indian and Burman species of the genera Pestalotia and Monochaetia.**—*Mycologia*, xxxiv, 3, pp. 308–317, 1942.

This paper records the result of an investigation of the species of *Pestalotia* and *Monochaetia* collected by Sir Edwin Butler and his colleagues over a period of nearly 20 years in India and Burma. The investigation revealed that there are 31 species of the former genus and two of the latter in these countries. *Pestalotia citri* n. sp. is recorded as occurring on living leaves of *Citrus decumana*, Kirkee, 1914, *P. pipericola*

n. sp. on leaves of *Piper nigrum*, Malabar, 1909, and *P. lawsoniae* n. sp. on leaves of *Lawsonia alba*, Pusa, 1906.

PINCKARD (J. A.) & BOZOVAISKY (L. S.). **Cold injury of flue-cured Tobacco seedlings.**—*Phytopathology*, xxxii, 6, pp. 512–517, 4 figs., 1942.

A disorder of tobacco seedlings prevalent in the 'bright' tobacco-growing areas of Virginia, where it is known as 'white' or 'yellow bud', is characterized by xanthosis of the young leaves enclosing the growing point, followed in severe cases by necrosis of the marginal cells and sometimes by temporary retardation of growth. Mature leaves damaged by cold exhibit irregular patterns and blanching. A similar condition was observed by Valleau and Johnson in Kentucky (*Plant Dis. Reptr*, xxiv, 12, pp. 236–238, 1940), where it was correctly diagnosed as due to cold injury, the same factor being operative in the present studies, in which the typical symptoms were induced by 2 to 3 hours' exposure to temperatures between 24° and 26° F. or 15 to 16 hours at 29° to 32°, thickening and glazing of the foliage being particularly marked at the former range; by the fifth day after treatment the abnormalities were obvious. In the field the trouble occurs when the warm days of early spring are interrupted by brief cold spells.

CLAYTON (E. E.), GAINES (J. G.), SHAW (K. J.), SMITH (T. E.), FOSTER (H. H.), LUNN (W. M.), & GRAHAM (T. W.). **Gas treatment for the control of blue mold disease of Tobacco.**—*Tech. Bull. U.S. Dep. Agric.* 799, 38 pp., 7 figs., 1942.

In controlled experiments using glass and wood enclosures approximately 1 yd. square, benzol treatment rising to a maximum concentration of 0·1 per cent. during the period 4.30 p.m. to 8 a.m. gave complete control of blue mould disease of tobacco (*Peronospora tabacina*) [*R.A.M.*, xx, p. 430], partial control resulting from even the lowest concentration used (maximum of 0·018 per cent.); moderate retardation of growth occurred only with much higher concentrations (maximum of 0·83 per cent.). Benzol concentrations (determined by means of the Mine Safety Appliance Co. instrument) in plant-beds in which disease control has been obtained reached maximum readings of 0·5 and 0·6 per cent., but in many beds they fell between 0·1 and 0·2 per cent. The results of many tests over several years showed that effective control can be obtained by applying benzol treatment twice a week at the rate of 5 qts. per 100 sq. yds. of bed, providing for an evaporating pan surface of one-hundredth of the bed area with the aid of cloth wicks and with pans 8 to 10 ft. apart, and a muslin cover, 60 to 65 thread count, weighing about 4½ oz. per sq. yd.

In tests with other vapours, xylol was found to be about 2½ times as effective as benzol, beta-trichloroethane 5 times, and pentachloroethane about 15 times as effective; however, it is understood that the supplies of xylol are limited, while pentachloroethane has the serious disadvantage that the treated plants wilt severely when exposed to bright sun.

Extensive studies on treatment with para-dichlorobenzene showed that the vaporization rate of this material depends on the size of crystals, type and size of surface over which the crystals are scattered, and temperature. The rate was found to increase as the size of crystals decreased from grade 1 (average diameter 11·93 mm.) to 9 (0·93 mm.); still smaller crystals tended to aggregate and were therefore unsatisfactory. Vaporization from an open surface of tobacco cloth or wire mesh was almost twice as rapid as from solid board surface. When the area over which the crystals were scattered was increased from $\frac{1}{18}$ of the bed area to $\frac{1}{9}$ (at the rate of 3 lb. per 100 sq. yds.) or to $\frac{1}{6}$ (4½ lb. per 100 sq. yds.), the rate of vaporization increased on the average from 40·2 to 69·9 and from 27·5 to 66·8 per cent., respectively. It was found that the effect of temperature on vaporization can to some extent be compensated by the size of crystals and the size of the area over which they were scattered. Thus, under very cool conditions the smallest crystals (grade 9) and the

widest distribution (over the entire bed) were most effective, whereas under warm conditions larger crystals and distribution on board shelves or in wire baskets were more satisfactory. Generally speaking, vaporization rates below 45 per cent. were ineffective, and above 93 per cent. likely to cause injury to the plants. Maximum vaporization usually occurred during the first one-third of the night. Using grade 9 crystals on warm nights almost all the para-dichlorobenzene may evaporate during this first period and cause severe plant injury. The best control was obtained with vaporization throughout the night (4.30 p.m. to 8 a.m.), and treatment during the first half of the night was more effective than during the second half. Daytime treatment was ineffective and frequently caused severe injury to the plants.

Practical recommendations, based on these studies, for the treatment with para-dichlorobenzene have already been noticed from another source [ibid., xx, p. 282].

Most growers are stated to consider any form of benzol treatment as too cumbersome, and to provide benzol at moderate cost tank-car distribution would be required. On the other hand, para-dichlorobenzene is readily available in small quantities and is more convenient to use, but because the margin of safety is less than with benzol, the limitations of the chemical, particularly with respect to vaporization, must be thoroughly appreciated.

ANDERSON (P. J.). **A successful spray for blue mold of Tobacco.**—*Plant Dis. Reptr*, xxvi, 8, pp. 201–202, 1942. [Mimeographed.]

Experiments on four crops of tobacco during the winter of 1941 in the greenhouse, and in the spring of 1942 in seed-beds demonstrated that spraying with ferric dimethyl dithiocarbamate [*R.A.M.*, xxi, p. 383] gave 95 to 100 per cent. control of *Peronospora tabacina* [ibid., xx, p. 429]. The best results were given by a solution of 1½ to 2 gm. of the material per l. of water, plus an equal amount of lime. Spraying was effected twice weekly. The substance in question is being introduced by Du Pont under the trade name 'fermate'.

PHILLIPS (J. H. H.). **Three strains of Cucumber mosaic occurring on Tobacco in Ontario and Quebec.**—*Canad. J. Res.*, Sect. C, xx, 6, pp. 329–335, 1 pl., 1942.

Tobacco in Ontario and Quebec was found to be affected by three strains of cucumber mosaic virus. Strain 1 most closely resembled typical cucumber mosaic virus in its symptoms on tobacco and tomato. Strain 3 produced a similar kind of mottle, but was generally more severe, and consistently produced severe leaf-narrowing on tomato. Strain 2 was easily recognized by its ability to produce necrotic rings on the inoculated leaves of Burley tobacco varieties, and the tendency of affected plants to recover from the initial symptoms. All three strains retained their identity through many serial inoculations.

A severe type of streak resulted when tomato plants were inoculated with a combination of cucumber mosaic virus (strain 3) and potato X virus.

The cucumber mosaic virus was unable to overwinter in plant tissue in the soil.

THOMAS (H. R.). **A defoliation of Tomatoes in Indiana controlled by spraying with manganese sulphate.**—*Plant Dis. Reptr*, xxvi, 8, pp. 198–199, 1942. [Mimeographed.]

In 1940 and 1941 tomatoes in various counties of Indiana became severely defoliated. The first symptoms of the condition were chlorosis and inward rolling of the leaflets, followed by necrotic spotting. The affected areas enlarged, coalesced, and finally caused the leaflets to wither and die. Severely affected plants showed only a tuft of leaves at the tips of the stems; affected plants were stunted, with a light green colour which enabled the diseased patches to be distinguished from the edge of the field.

In 1940 solutions of manganese sulphate, ferric sulphate, borax, and zinc sulphate were sprayed on to affected plants, while in some cases, instead of these treatments, sulphuric acid solution was added to the soil. Only the plants sprayed with manganese sulphate or growing in the acid-treated soil produced new growth without spotting. In one locality rapid recovery followed an early application in 1941 of manganese sulphate spray. It would appear that disturbance of the soil texture or environmental conditions affected manganese availability.

MILLER (J. H.) & GROGAN (R.). **Injury to Tomato seed in disinfection.**—*Phytopathology*, xxxii, 6, pp. 524–528, 2 graphs, 1942.

The effect on the germination of tomato seed of mercuric chloride (1 to 3,000) and new improved ceresan (1 to 1,200) was investigated at Athens, Georgia, by treating a constant weight of seed with increasing volumes of solution and increasing weights of seed with a constant volume of solution, and estimating germination after 4, 7, and 11 days. It was concluded that when the ratio of the seed weight to the volume of the treating solution is increased above 1 to 8 germination is progressively impaired. No significant difference was observed between the two solutions, each of which at a ratio of 1 to 8 gave complete disinfection without seriously affecting germination.

MIELKE (J. L.) & KIMMEY (J. W.). **Heat injury to the leaves of California Black Oak and some other broadleaves.**—*Plant Dis. Reptr*, xxvi, 5, pp. 116–119, 1 graph, 1942. [Mimeographed.]

Early in July, 1941, California black oak trees (*Quercus kelloggii*) growing over a wide area in northern California developed a reddish-brown discoloration of the leaves, which in one locality was so pronounced that it imparted a characteristic hue to entire mountain-sides. On the affected leaves (except for a few that became completely discoloured) the browning was confined mainly to a broad, irregularly shaped band round the margins. Many of the most severely affected leaves fell soon after the injury became apparent, but the greater part remained attached to the trees during most of the summer. A few trees lost nearly all their leaves in July, and most of these produced a small crop of new leaves in late July and early August, together with new woody growth. No causal organism appeared to be associated with the condition, which is attributed to injury to the young leaves brought about by a sudden rise in temperature between 5th and 12th July, when the thermometer rose to 105° F.; the discoloration became evident a few days later.

MARCHIONATTO (J. B.). **Las especies de Cyttaria y Cyttariella en la Argentina.** [The species of *Cyttaria* and *Cyttariella* in the Argentine].—*Darwiniana, B. Aires*, iv, 1, pp. 9–32, 7 pl., 3 figs., 1940. [English summary. Received September, 1942.]

This is a critical discussion and revision of the genera *Cyttaria* and *Cyttariella* [*R.A.M.*, xii, p. 116] in the Argentine, where the occurrence of the following species on various species of *Nothofagus* has been established: *Cyttaria darwinii*, *C. harioti*, *C. espinosae*, *C. hookeri*, with three new forms, viz., *typica*, *moroidea*, and *candida*, *C. intermedia*, *Cyttariella deformans*, and *C. skottsbergii*. Three types of tumours are produced by the species of *Cyttaria* under observation, namely, voluminous, tending to encircle the branches and trunk of the host, by *C. harioti*, *C. darwinii*, and *C. espinosae*; small and gregarious, extending along the branches, by *C. hookeri*; and witches' brooms, by *C. darwinii*. The pathological manifestations of *Cyttariella deformans* resemble those of *Cyttaria hookeri*, while *Cyttariella skottsbergii* was found in association with *Cyttaria hookeri* f. *moroidea*.

**Spread of White Pine blister rust during 1941.**—*Plant Dis. Reptr*, xxvi, 3, pp. 76–80, 1942. [Mimeographed.]

During 1941 *Cronartium ribicola* [*R.A.M.*, xxi, pp. 29, 355] spread in a southerly

direction on *Ribes* spp. from central Virginia and West Virginia into northern Tennessee and North Carolina, while large numbers of cankers were found for the first time on sugar pine (*Pinus lambertiana*) in northern California and southern Oregon in districts where *Ribes* spp. had been found infected in previous years. In the Appalachian region infection spread southwards on wild *Ribes* for about 134 miles. In California the disease spread southwards in the Coast Range for 200 miles and in the Sierra Nevada for 170 miles; tangible evidence was obtained that infection is beginning to establish itself over a wide area in the northern part of the State. The year appeared to have been exceptionally favourable for rust intensification in the western white pine [*P. monticola*] region of north-eastern Washington, northern Idaho, and north-western Montana, owing to exceptionally wet conditions. In the north-central States the disease was recorded on white pine (*P. strobus*) in three more counties in each of Minnesota and Wisconsin, and one more in Michigan.

Pomerleau (R.). **Deux maladies des conifères en pépinière.** [Two diseases of conifers in the nursery.]—*Forêt québéc.*, iii, 9, pp. 13–22, 3 figs., 1941. [Abs. in *Biol. Abstr.*, xvi, 6, p. 1452, 1942.]

From 1931 to 1936 damping-off losses in the forest nursery at Berthierville, Quebec, ranged from 19·5 per cent. for white spruce [*Picea glauca*] in 1932 to 97·5 per cent. for red pine [*Pinus resinosa*] in 1934. The greatest mortality was due to *Fusarium* spp. Other fungi that caused damage were *Rhizoctonia* [*Corticium*] *solani* and *Pythium de Baryanum.* In 1934 the heaviest loss from the last-named occurred soon after the seeds germinated (11th June), while that from *C. solani* occurred a week or two later, and that from *F.* spp. about four weeks after germination (3rd July).

Sowing in soil rich in humus favoured germination in dry weather and damping-off in wet. To sow in soil with little organic matter is the safest procedure. Pine seed should be covered by not more than $\frac{1}{4}$ in. of soil, and spruce by not more than $\frac{1}{8}$ in. The seed should be sown not more than 150 to the running foot in drills, or 500 to the sq. ft. if broadcast. When sowing is done in spring, zinc sulphate, aluminium sulphate, or hydrogen sulphate should be applied to the seed-bed at the rate of $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{8}$ oz. per 1 pt. water per sq. ft., respectively.

The snow fungus (*Phacidium infestans*) [*R.A.M.*, xix, p. 54; xxi, p. 356] also caused much damage, especially to fir and spruce in nurseries and plantations. Control results from the application of sulphur sprays.

Cooke (W. B.). **Resupinate pore fungi.**—*Amer. Midl. Nat.*, xxvii, 3, pp. 677–695, 1942.

This is a critically annotated list of 39 species of *Poria* occurring in Oregon, mostly on logs or rotten wood of conifers and hardwoods, preceded by a history and discussion of the genus and keys to the species enumerated. *P. weirii* is the agent of a severe butt rot of *Thuja plicata* [*R.A.M.*, xx, p. 435; xxi, p. 110].

Birkinshaw (J. H.), Findlay (W. P. K.), & Webb (R. A.). **Biochemistry of the wood-rotting fungi. 3. The production of methyl mercaptan by Schizophyllum commune Fr.**—*Bio-chem. J.*, xxxvi, 5–6, pp. 526–529, 1942.

In the course of cultural tests to determine the most appropriate sources of nitrogen for various wood-rotting fungi, a very disagreeable odour [cf. *R.A.M.*, xix, p. 54 *et passim*], resembling that of decaying cabbage, was exhaled by *Schizophyllum commune*, originally isolated from kiln-dried African mahogany [*Khaya senegalensis*] on a synthetic medium containing ammonium and magnesium sulphates. An analysis of air drawn over the cultures revealed the presence of methyl mercaptan and (probably) traces of hydrogen sulphide.

Brooks (R. L.). **The preservation of timber.**—*J. Instn Petrol. Tech.*, xxviii, 220, pp. 63–81, 1942.

In view of the recent large consumption of indigenous wood (nearly double that of normal years) by the Trinidad petroleum companies, stringent economy to prevent waste is imperative. Hitherto, preventive and remedial measures against the decay and destruction of timber by fungi and insects have been virtually non-existent in the Colony, and recommendations are accordingly made for the prolongation of durability by the use of appropriate kinds of wood and treatment with a reliable preservative. Among the imported and indigenous woods most resistant to fungal depredations are balata [? *Manilkara bidentata*], bois mulâtre [*Pentaclethra macroloba*], guatecare [*Eschweilera subglandulosa*], pitch pine [*Pinus rigida*], Douglas fir [*Pseudotsuga taxifolia*], white fiddlewood [*Citharexylum* spp.], red mangrove [*Rhizophora racemosa*], white olivier, yellow olivier [*Chuncoa obovata*], and sandbox [*Hura crepitans*]. Timbers for industrial concerns to be placed in contact with the ground or exposed to weather or abrasion, e.g., posts, poles, and bridgework, should be treated with a half-and-half mixture of creosote and diesel oil by the pressure or open-tank process, while those intended for dwelling-houses, offices, and the like should be impregnated with a water-soluble salt, such as zinc chloride, which is stated to have proved serviceable in Panama; in this case the preservative treatment should be followed by the application of paint. For interior timbers the dipping, spraying, or brushing methods of treatment may be substituted for the open-tank or pressure processes.

Zycha (H.). **Der Einfluss stickstoffhaltiger Salze auf die Zerstörung von Bauholz durch Pilze.** [The influence of nitrogenous salts on the decay of structural timber by fungi.]—*Angew. Bot.*, xxi, 6, pp. 455–472, 5 figs., 1939. [Received August, 1942.]

Most of the information on the influence of nitrogenous salts on the decay of structural timber by *Coniophora cerebella* [*C. puteana*] and *Paxillus acheruntius* [*P. panuoides*], as determined by laboratory experiments at the Hann.-Münden Institute of Forest Botany, has already been noticed from another source [*R.A.M.*, xix, p. 446]. In a test in which calcium nitrate and magnesium sulphate were added to pure cultures of *P. panuoides* on wooden sticks in dry quartz sand at the rates of 0·3, 0·6, and 1·2, and 0·5, 1·0, and 2·0 gm., respectively, the losses of weight at a moisture content of 54 per cent. after three to four months were 19·3, 18·1, 4·3, 7·1, 7·5, and 3·2 per cent., respectively, the corresponding figures for calcium nitrate (0·3 gm.) and the three magnesium sulphate doses at 47 per cent. humidity being 8·3, 5·2, 5·3, and 2·7 per cent., respectively; the control losses at the lower and higher moisture contents were 4·1 and 7·1 per cent., respectively.

Mention is further briefly made of the attraction of soluble salts for the dry rot fungus, *Merulius lacrymans* [ibid., xv, p. 695], which affords an additional reason for the stringent exclusion of organic matter from the clay used as a filler for ceilings.

Borg (J.). **Ett och annat om kostnader för stängelstolpar samt ev. impregnering av dessa.** [One thing and another concerning the cost of fence posts and their eventual impregnation.]—*Svenska Vall-MosskFören. Kvart.*, iv, 1, pp. 49–63, 1942.

This is a discussion of the cost of fence posts for agricultural concerns in Sweden, and of the economics of impregnation against fungal decay. For the moment the only treatment that can be recommended as practicable is preservation with arsenic salts with a 0·1 per cent. arsenic acid content [*R.A.M.*, xix, pp. 58, 631; xxi, p. 107], carried out either by the open-tank or osmosis process [ibid., xx, p. 505 *et passim*].

BRANDENBURG (E.). **Über Bormangel an Blumenkohl und Kohlrabi.** [On boron deficiency in Cauliflower and Kohlrabi.]—*Angew. Bot.*, xxiv, 1–2, pp. 99–113, 9 figs., 1942.

Snowball cauliflowers grown in 10 kg. pots containing quartz sand plus 2 per cent. peat and a synthetic solution devoid of boron, as well as in a soil naturally deficient in boron (lime-sandstone) in 1939, developed pronounced pathological symptoms [*R.A.M.*, xx, pp. 518, 554], including malformation of the young leaves, which in some cases were reduced to the midrib and a narrow, irregular lamina, delayed heading, and glassiness of the tissues of the main stem and lateral branches of the head, the top of the latter sometimes assuming a brown discoloration. The application of adequate quantities of boric acid (15, 20, or 30 mg. in the pot tests, 10 mg. being definitely insufficient) corrected all the adverse effect of the shortage and resulted in the production of fine, firm heads. In the natural soil test the heads of plants receiving 30, 15, and 0 mg. boron weighed, respectively, 85, 79·4, and 14·8 gm. In a further test in 1940, using a boron-deficient soil which had supported a beet crop in the previous year, a dose of 60 mg. borax was necessary to produce results comparable to those secured in the first 1939 trials with 30 mg., showing the effect of a withdrawal of the element by the beets [ibid., xviii, p. 428].

Kohlrabi deprived of boron under similar conditions to the foregoing developed a scabby condition of the epidermis and a grey to brown, glassy discoloration of the bulbous roots, resembling that of swedes affected by brown heart [ibid., xvi, p. 430; xxi, p. 426, *et passim*] and imparting an unpalatable softness and insipidity to the flesh. In this case also the undesirable symptoms were corrected by treatment of the soil with 30 mg. boric acid, which increased the leaf and root weights by 65 and 35 per cent., respectively.

AFANASIEV (M. M.) & MORRIS (H. E.). **Control of seedling diseases of Sugar Beets in Montana.**—*Phytopathology*, xxxii, 6, pp. 477–486, 2 graphs, 1942.

Seed treatments with ceresan and new improved ceresan at the rates of 4 and 1 oz., respectively, per 20 lb. lots were found to be of little avail in the control of beet seedling diseases (*Phoma betae*, *Pythium* spp., and *Rhizoctonia* spp. [*R.A.M.*, vi, p. 709], predominantly the first-named) in 1939 and 1940 at the Montana Agricultural Experiment Station, where the best results were secured by the application of complete and balanced soil amendments as follows: nitrogen (250 lb. calcium nitrate per acre, half at planting time, and the remainder as a side-dressing immediately after thinning), treble superphosphate (175 lb.), and manure (14·75 tons in 1939 and 22 tons in 1940), or the same with the addition of lime at 1,000 lb. per acre, the plots in this series showing the minimum of infection (averages of 21 to 27·1 per cent.) and giving the maximum yields of 15·3 to 16·7 tons per acre. In plots receiving nitrogen and phosphorus or manure and phosphorus seedling diseases were prevalent but the yields were fairly satisfactory. A high incidence of disease was registered in the control plots and in those receiving unbalanced fertilizers, especially nitrogen alone. The application of lime alone resulted in a high percentage of seedling disease, and poor stands and yield. It is concluded that seedling diseases of sugar beet in the heavy irrigated lands under observation can be controlled by soil treatments promoting rapid and healthy development of the seedlings.

TOLMAN (B.) & MURPHY (A.). **Sugar-beet culture in the intermountain area with curly top resistant varieties.**—*Fmrs' Bull. U.S. Dep. Agric.* 1903, 52 pp., 28 figs., 1 map, 1942.

Stressing the increased importance of sugar beet production in war time, this popular leaflet gives recommendations for the cultivation, soil management, and control of pests and diseases, of which curly top [*R.A.M.*, xxi, p. 316] is stated to be the most serious danger to beet crops in Utah, Idaho, Oregon, and Washington,

damping-off or black root, and root rots (*Rhizoctonia* spp. including *Corticium solani*) being of minor importance. In Utah and Idaho Russian thistle [*Salsola kali* var. *tenuifolia*], mustards, and filaree [*Erodium* spp.] are the most important weed hosts of the insect vector (*Eutettix tenellus*) and may also serve as the source from which the insects obtain the virus. Over-grazing is the chief factor causing an increase in the weed hosts in the range lands constituting the breeding grounds for the vector, and controlled grazing for even three or four years has been shown to accomplish much in reducing such breeding areas.

McNew (G. L.) & Hofer (A. W.). **Should chemically treated Pea seed be inoculated?** —Reprinted from *Canner*, 2 pp., 1 fig., 1942.

Greenhouse tests with various disinfectants commonly used for the control of [unspecified] soil-inhabiting fungi on peas [cf. *R.A.M.*, xx, p. 241] showed that pea plants inoculated with cultures of nodule bacteria [*Rhizobium leguminosarum*] following treatment with cuprocide (red copper oxide), semesan (hydroxymercurichlorophenol), or 2 per cent. ceresan (ethyl mercury chloride) developed no, or only a few, nodules, and only those grown from inoculated seed treated with spergon (tetrachloroparabenzoquinone), at the rate of 1, 2, or 4 oz. per bush., consistently had nodules comparable in number, size, and location to those on plants grown from untreated seed. It was found that spergon killed about 50 per cent. of the bacteria, while the other disinfectants killed practically all. The growth of the bacteria in pure culture on agar media was inhibited by the addition to the nutrient medium of semesan or 2 per cent. ceresan in doses as small as 1 part in 100,000, while cuprocide and spergon achieved the same only when added at a rate heavier than 1 part in 1,000. When blocks of agar containing 1 per cent. of either spergon, cuprocide, or 2 per cent. ceresan were placed in sterile dishes and covered with melted agar containing millions of nodule bacteria in suspension, it was found that enough ceresan escaped from the block to sterilize the entire plate, cuprocide diffused out and killed the bacteria for some distance, and finally spergon killed only the few bacteria in immediate contact with the agar block. The results of this test are believed to represent roughly the respective effects of the three chemicals on the bacteria on the seed. Results of greenhouse tests, as yet not confirmed by field trials, showed that seed treated with spergon can be successfully inoculated with nodule bacteria provided only strong, viable cultures are used and these are applied immediately before planting to seed treated with not more than 1½ oz. of the disinfectant per bush.

McNew (G. L.). **Lima Beans' response to seed treatment in field tests.**—Reprinted from *Canner*, 3 pp., 2 figs., 1942.

In preliminary experiments in the laboratory and greenhouse spergon [see preceding abstract], new improved semesan jr., and tetramethyl thiuramdisulphide (Dubay 1205–FF) of all the chemicals tested seemed to afford a promising amount of protection against [unspecified] seed-decaying fungi, which are stated to be very destructive to Lima bean [*Phaseolus lunatus*] stands in New York State, particularly in rain-soaked soils. The last-named chemical has not yet been tested in the field and, therefore, cannot be recommended for general use at present. The other two and a mixture similar to spergon, designated No. 528, were subjected to field trials during 1941. It was found that the yields of Henderson's Bush Lima beans were increased by treatment with spergon (2 oz. per bush.) in four different tests by 135, 636, 84, and 721 lb. of beans per acre, respectively, the use of 1 oz. per bush. increasing the yields by 147 and 652 lb. per acre in the first and third tests. The two other materials were less effective than spergon, No. 528 producing an increase in yield of 102 lb. and new improved semesan jr. (1½ oz. per bush.) one of 340 lb. over the untreated controls of the second and fourth tests, respectively. In a test where seed

was planted after the rain, treatment with spergon and new improved semesan jr. improved the emergence, but the yields were increased by only 63 lb. by the former and not at all by the latter dressing. The cost of spergon treatment did not exceed 10 cents an acre. Although results are available for only one season, in which, moreover, the conditions were not favourable for seed decay, enough evidence is stated to exist to warrant recommending spergon for treatment of Lima bean seeds.

Hähne (H.). **Beiträge zur Frage der Bekämpfung der durch Pseudomonas medicaginis var. phaseolicola Berk. verursachten Fettfleckenkrankheit der Bohne.** [Contributions to the problem of the control of the Bean grease spot disease caused by *Pseudomonas medicaginis* var. *phaseolicola* Berk.]—*Angew. Bot.*, xxiv, 1–2, pp. 31–61, 1942.

Of recent years the grease spot disease of beans [*Phaseolus vulgaris*] caused by *Pseudomonas medicaginis* var. *phaseolicola* has assumed an alarming extension in Germany, where the affected regions observed by the writer on tours of inspection in 1936 included Bavaria, Württemberg, Baden, Hesse, Rhineland, Oldenburg, Hanover, Schleswig-Holstein, Mecklenburg, Thuringia, and the Saxon Free State, all of which were supplied with seed by firms in the infested zone of the eastern Harz Mountains. The investigations herein reported were concerned with the control of the disease, against which prophylaxis by the exclusive use of sound seed was experimentally shown to be unavailing for the following reasons. Grease spot is so widespread that the number of unaffected fields available as sources of seed is quite inadequate to meet the demand. The mere rejection of seed externally recognizable as infected is useless, since such material is generally non-viable, and therefore of no practical consequence for the perpetuation of the pathogen, and, moreover, apparently healthy seed may be internally diseased. Chemical seed disinfection removes only the bacteria adhering to the outer surface, and the more effective method of immersion in hot water is impracticable on account of the injury inflicted on most varieties by the treatment. Healthy seed cannot be secured by the eradication of all plants with grease-spot symptoms, since the pathogen may be present in a concealed form in those of sound external aspect.

In addition to the cultivation of resistant varieties, a report on which has already appeared [*R.A.M.*, xv, p. 697], quasi-complete commercial freedom from grease spot may be secured, on a financially satisfactory basis, by two or three applications of 0·5 to 1 per cent. Bordeaux mixture, other copper-containing and copper-free preparations being, respectively, less effective and useless. The increases in seed production obtained by spraying were substantial, amounting in the susceptible Wax Olainville variety, for instance, to 65·7 per cent., the corresponding figure for the more resistant Stringless Geneva Market being 17·1 per cent. While this method is quite reliable for all practical purposes, it cannot be guaranteed to produce seed of the absolute purity requisite for the total elimination of the pathogen, which demands the use of carefully selected lines as previously reported.

Kreutzer (W. A.) & Glick (D. P.). **Control of anthracnose spot of Honey-dew Melons.**—*Fm Bull. Colo. agric. Exp. Sta.*, iv, 1, pp. 9–11, 1942. [Abs. in *Chem. Abstr.*, xxxvi, 13, p. 3898, 1942.]

The agent of melon anthracnose, *Colletotrichum lagenarium*, is spread from diseased to healthy melons by means of the washing water, which should be disinfected by the introduction of chlorine at a minimum concentration of 150 p.p.m., the same treatment being recommended for conveyor belts. All the spores in suspension were killed by contact with commercial hypochlorites in amounts equivalent to chlorine concentrations of 120 to 1,000 p.p.m., even stronger solutions being quite innocuous to ripe melons.

IMPERIAL MYCOLOGICAL INSTITUTE

# REVIEW
OF
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Thompson (R. C.) & Doolittle (S. P.). **Influence of temperature on the expression of big-vein symptoms in Lettuce.**—*Phytopathology*, xxxii, 6, pp. 542–544, 1 fig., 1942.

Big vein of lettuce, originally reported from the Imperial Valley of California [*R.A.M.*, xiv, p. 283], was observed during the last five years in New Jersey, Maryland, and North and South Carolina. In the greenhouse at Beltsville, Maryland, the typical symptoms of the disease, including enlargement and bleaching of the vascular regions of the petioles and leaf blades, veinbanding, and savoying, developed in plants maintained first at day and night temperatures of 65° to 75° and 50° to 60° F., respectively, then (at the stage of seed-stem elongation) for three weeks at 50° to 60° and 45° to 50°, respectively, and ultimately (until maturity) at the original day and night temperatures. The big-vein symptoms first became noticeable during the period of lowered temperatures and were completely obscured in the subsequent growth made after the restoration of warmer conditions, though persisting in the leaves formed while the drop in temperature was in operation.

Snyder (W. C.) & Rich (S.). **Mosaic of Celery caused by the virus of Alfalfa mosaic.**—*Phytopathology*, xxxii, 6, pp. 537–539, 1 fig., 1942.

Golden Self Blanching celery was successfully inoculated with the aid of a carborundum abrasive at Berkeley, California, with juice from broad bean, *Petunia hybrida*, white clover (*Trifolium repens*), and *Melilotus indica* artificially infected by the lucerne mosaic virus from four localities in the State, the incidence of transmission [*R.A.M.*, xix, p. 358] being usually low but amounting in a few trials to 50 per cent. or more. The thermal inactivation point of the virus was found to lie between 60° and 65° C., its dilution end point to range from 1 in 2,000 to 1 in 3,000, and its longevity *in vitro* to persist for three to five days; it is transmissible by means of the pea aphid (*Illinoia* [*Macrosiphum*] *pisi*) [ibid., xx, p. 472]. The recovery of the virus from celery was effected by the mechanical inoculation of such hosts as lucerne, broad bean, cowpea, *Vigna sesquipedalis*, soy-bean, petunia, sweet pea, and white clover. The symptoms induced by the virus on celery consist of a faint to prominent, yellow-green mosaic, mostly of the outer leaves, in severe cases presenting a conspicuous calico-like pattern of lemon-yellow patches on a green background. Other features of the disorder may include mild blistering, a tendency to foliar distortion, vein-clearing, and the formation of yellow or cleared rings or round areas of green tissue. A mosaic of this type is frequently present on celery growing in proximity to diseased lucerne, suggesting a direct connexion between the mosaic of the latter and the signs of infection on the former.

Niethammer (Anneliese). **Beiträge über die Kulturfähigkeit des Champignons Psalliota campestris.** [Studies on the cultivation of the Mushroom *Psalliota campestris*.]—*Zbl. Bakt.*, Abt. 2, cv, 7–9, pp. 129–130, 1942.

The following media have given good results in the culture of the edible mushroom,

*Psalliota campestris*, at a temperature of 23° to 25° C., at the German Technical College, Prague, Czechoslovakia: 1·5 per cent. beer wort agar; soil decoction ($\frac{1}{2}$ kg. soil left to stand in $1\frac{1}{2}$ l. water for 24 hours, then steamed for one hour, filtered, and 1 per cent. ammonium sulphate added); wood pulp moistened with a synthetic solution of Stapp and Bortels (*Zbl. Bakt.*, Abt. 2, xc, p. 48, 1934), consisting of 0·5 gm. ammonium sulphate, 0·25 gm. potassium phosphate, and 0·1 gm. magnesium sulphate, made up to 1,000 c.c. with tap water; and oat glumes moistened with the same solution and enriched with 1 per cent. horse liver or faecal extract.

Gratz (L. O.). **The perfect stage of Phomopsis vexans.**—*Phytopathology*, xxxii, 6, pp. 540–542, 2 figs., 1942.

In the course of cultural studies on *Phomopsis vexans*, the agent of a serious disease of eggplant, at the Florida Agricultural Experiment Station in 1939 and 1941, the writer observed on 2 per cent. potato dextrose agar the development of perithecia, 130 to 350 $\mu$ in diameter, occurring in clusters embedded in the carbonaceous stromatic tissue, furnished with beak-like, carbonaceous, sinuate ostioles, 80 to 500 $\mu$ in length, and occupied by clavate, sessile, hyaline, thin-walled asci, 28 to 44 by 5 to 12 (average 36 by 8·9) $\mu$, containing eight biseriate, hyaline, narrowly ellipsoid to bluntly fusoid, bicellular spores, 9 to 12 by 3 to 4·4 (10·8 by 3·7) $\mu$. Inoculations on eggplant seedlings with perithecial or ascospore suspensions gave rise to the typical lesions of 'tip over' (the local name for the blight in Marion County) bearing pycnidia, though the spots were not as abundant as those resulting from infection with pycnospores. The perithecial stage of the fungus, which is named *Diaporthe vexans* (Sacc. & Syd.) n. comb., has not yet been observed in nature.

Snyder (W. C.). **A seed-borne mosaic of Asparagus Bean, Vigna sesquipedalis.**—*Phytopathology*, xxxii, 6, pp. 518–523, 2 figs., 1942.

In 1938 a small proportion (3·3 per cent.) of a commercial lot of Yardlong asparagus beans (*Vigna sesquipedalis*) at the University of California, Berkeley, developed a pale and dark green foliar mosaic frequently accompanied by downward rolling of the leaflets, mild rugosity or distortion, veinbanding, and stunting. Often the dark green areas formed broad bands along the chief veins, the remainder of the leaf being lighter green. The virus was transmitted from diseased to healthy plants both by the mechanical inoculation of expressed juice and through the agency of the pea aphid, *Macrosiphum pisi*. Attempts to infect other legumes were mostly unsuccessful, but cowpeas responded to inoculation by the development of symptoms resembling those of cowpea mosaic [*R.A.M.*, xxi, p. 444] while the features of the disease on beans (*Phaseolus vulgaris*) were unlike those of common mosaic (bean virus 1). The asparagus bean virus was found to be transmissible through the seed to the extent of 37 per cent., approximating in this respect to the mosaics of bean, cowpea, and soy-bean (virus 1) [ibid., xv, p. 418]. The thermal inactivation point of the asparagus bean virus was found to lie between 55° and 60° C., its longevity *in vitro* to persist for about two days, and its dilution end point to be situated nearer 1 in 1,000 than 1 in 3,000.

Vasudeva (R. S.). **A mosaic disease of Cowpea.**—*Indian J. Agric. Sci.*, xii, 1, pp. 281–283, 2 pl., 2 figs., 1942.

Punjab type 1 cowpeas, inter-cropped with 'desi' cotton [*Gossypium indicum*] (Mollisoni 39 variety) in root-rot [*Macrophomina phaseoli* and *Corticium solani*] study plots at Lyallpur [*R.A.M.*, xxi, p. 450], developed symptoms of mosaic [ibid., iv, p. 203; xx, p. 444], of which three forms were differentiated, characterized primarily by (1) generalized stunting, more especially of the upper parts of the plant, thick, wrinkled foliage, vein-clearing, mottling, the dark green areas alternating with the yellow patches being sometimes raised like blisters, and marginal undulations;

(2) uniform foliar chlorosis without thickening or distortion; and (3) very conspicuous mottling, with pale to vivid yellow areas, later turning brownish, dark reddish discoloration of the veins, including the midrib, and dark brown or reddish spots, 1 to 2 mm. wide, on the upper leaf surface. Some 15 per cent. of the plants were affected in the mixed plots (the cotton being quite healthy), and the disease was further observed in a pure stand of Punjab type 3 cowpeas at the students' farm.

Transverse sections through diseased leaves showing typical form (1) symptoms revealed fusion of the cuticle and epidermal layer at various places along the wavy margins, paucity of palisade cells, which contain few chloroplasts, and discontinuity and irregularity of the tissues, abnormality of the spongy parenchyma, thickening and enlargement of the sclerenchyma cells and xylem vessels, and dispersion and disarrangement of the vascular bundles; the spongy and palisade tissues appeared to have been partially replaced by a number of elongated and irregular cells.

The juice from leaves of plants showing all the three above-mentioned types of mosaic was introduced separately by smearing on to the pricked foliage of healthy plants, all of which developed yellow mottling without distortion within five days.

Cook (H. T.) & Harter (L. L.). **Wettable spergon not effective as a surface disinfectant of Sweet Potatoes used for seed.**—*Plant Dis. Reptr*, xxvi, 9, p. 222, 1942. [Mimeographed.]

Experimental data are given showing that wettable spergon [*R.A.M.*, xxi, p. 360] is unsuitable for treating sweet potato 'seed' for the control of black rot (*Ceratostomella fimbriata*).

Daines (R. H.). **Spergon (chloranil) and scurf control of Sweet Potatoes.**—*Plant Dis. Reptr*, xxvi, 7, pp. 160–161, 1942. [Mimeographed.]

Experimental data are given showing that treatment of sprouts from sweet potatoes severely affected by scurf (*Monilochaetes infuscans*) with wettable spergon [see preceding and next abstracts] (1 lb. to 5 qts. water) was less effective than with semesan bel (1 in 10).

Davy (R. H.). **Further evidence of the fungicidal value of spergon.**—*Plant Dis. Reptr*, xxvi, 7, pp. 162–163, 1942. [Mimeographed.]

In greenhouse trials carried out in Oklahoma in 1941 and 1942 treatment of the seed of Virginia soy-beans and hairy vetch (*Vicia villosa*) with new improved ceresan (½ oz. per bush.) and spergon (tetrachloroquinone) [see preceding abstract] (2 oz. per bush.) effectively prevented seed rots and pre-emergence damping-off in soil naturally infested with *Rhizoctonia* [*Corticium*] *solani*, the means of emergence counts being 99 and 117·5 for soy-beans against 59 for the controls and the corresponding figures for vetch 160, 170, and 145, respectively. The differences between ceresan and spergon were not statistically significant.

Peyer (E.). **Die Erfahrungen mit schwach konzentrierter Bordeauxbrühe bei der Mehltaubekämpfung in den Reben der deutschen Schweiz im Sommer 1941.** [Experiences with dilute Bordeaux mixture for the control of Vine mildew in German Switzerland during the summer of 1941.]—*Schweiz. Z. Obst- u. Weinb.*, li, 8, pp. 173–178, 1942.

Over the whole of German Switzerland the effective control of vine downy mildew (*Peronospora*) [*Plasmopara viticola*] with dilute Bordeaux mixture (in connexion with the copper consumption economy campaign) [*R.A.M.*, xxi, p. 497] proved perfectly feasible in the summer of 1941, which was not, however, apart from the second half of June, a season conducive to intensive outbreaks of the disease. The correct timing of the treatments was more important than the concentrations of the Bordeaux mixture used and the following schedule was successfully adopted: one or two

pre-blossom sprays with 1 per cent. Bordeaux plus 1 per cent. lime-sulphur and two post-blossom with 1 to 1·5 per cent. Bordeaux plus 0·5 per cent. lime-sulphur, and supplementary treatments, where necessary, consisting of 1 to 1·5 per cent. Bordeaux only. The average consumption for four applications was 17·1 l. per are [100 sq. m.] or 67 l. per 100 vines.

**Fifty-fourth Annual Report of the Kentucky Agricultural Experiment Station for the year 1941.**—55 pp., [1942].

In this report on plant disease work in Kentucky in 1941 [*R.A.M.*, xx, p. 561] it is stated that the White Burley tobacco variety Ky 16 has now been certified by the Kentucky Seed Improvement Association for four years, and that the certified seed is on sale. Over 60 per cent. of the Burley tobacco crop in Kentucky and the neighbouring states is Ky 16, which outyields the other commonly grown varieties in fields infected with black root rot [*Thielaviopsis basicola*: loc. cit.] and on clean land has given 10 to 30 per cent. heavier yields per acre than the stand-up Burley varieties generally grown.

Growers in areas where *Fusarium* wilt [*F. oxysporum* var. *nicotianae*: ibid., xix, p. 678] is causing injury are growing the resistant White Burley variety Ky 33. It is fast-growing and early-maturing, and gives a tobacco of satisfactory quality, but it is not recommended for areas where this particular disease is not found.

A strain of Burley tobacco (Ky 48–7) homozygous for the N factor, obtained from *Nicotiana glutinosa*, has proved to be virtually immune from tobacco mosaic [ibid., xxi, p. 227]. The plant resembles Ky 16 in appearance, but is smaller, and yields less; in comparative tests, Ky 48–7 yielded only 77 per cent. as much per acre as Ky 16. Because of the heavy losses from mosaic in dark tobacco, attempts are being made to produce mosaic-resistant strains of several of the dark tobacco varieties grown in western Kentucky by introducing the N factor. In the heterozygous condition (for N) the hybrid strains appear to be almost identical with the original dark varieties. Progress is also being achieved in the development of mosaic-resistant dark varieties of the Ambalema type, which are also resistant to *T. basicola.*

An outbreak of a disease of Burley tobacco near Lexington was ascertained to be due to a virus common in *Plantago major* [ibid., xxi, p. 227] and first reported by the Station in 1930 [ibid., xi, p. 7]. About 2 per cent. of the plants were much stunted and rather necrotic; they somewhat resembled plants affected with streak. On the Keeley and Pepper tobacco varieties the virus causes local necrotic lesions, sometimes followed by systemic necrosis and chlorosis, while on Turkish and Ky 16 Burley tobacco it induces a systemic mottle mosaic with a pattern differing somewhat from that of ordinary tobacco mosaic.

A virus disease of lucerne characterized by irregular, yellow, occasionally nearly white areas on a few leaflets per plant was transmitted mechanically to tobacco. Chlorotic, sometimes necrotic, ring-and-line patterns developed on rubbed tobacco leaves, followed by yellow to almost white ring patterns in new leaves, which were generally small and distorted. The condition was also transmitted mechanically to pepper [*Capsicum* sp.], tomato, and cucumber, but mechanical transmission to pokeweed [*Phytolacca decandra*] and garden bean [*Phaseolus vulgaris*] gave only necrotic spots. The virus appears to be a strain of *Marmor medicaginis* H. [lucerne mosaic virus].

The tobacco streak virus was transferred from tobacco to sweet clover [*Melilotus* sp.] through dodder [*Cuscuta campestris*: cf. ibid., xx, p. 590]; in the sweet clover it caused a ring spot-like mottling resembling a common field disease of sweet clover. The virus was re-transferred from sweet clover to tobacco by dodder in one trial.

A leaf spot apparently due to phosphorus deficiency was noted on Burley tobacco. The affected plants were small, and the leaves, especially at the basal halves, had a chlorotic cast; numerous necrotic, circular spots were observed on many of the leaves.

The phosphorus content of the leaves and soil was low. Later, affected plants became rare, the roots presumably occupying relatively larger soil volumes.

Conclusive evidence was obtained that *Bacterium angulatum* [*Pseudomonas angulata*: ibid., xxi, p. 431] can overwinter in soil in the field. Between 2nd November, 1940, and 18th April, 1941, *P. angulata* was recovered from 37 out of 180 soil samples collected from fields where naturally infected tobacco had grown in 1940. From 542 soil samples collected from bluegrass [*Poa pratensis*] and clover fields *P. angulata* was isolated from 13 samples, each sample coming from a field adjacent to a tobacco field. The organism was isolated by pouring a water suspension of soil over the under-surface of a water-soaked leaf, the bacteria being obtained from the leaf spot. Other evidence suggested that the bacteria can be washed from infected leaves into the soil by rain, and that as few as three or four individuals suffice to cause leaf spotting.

BARDUCCI (T. B.). **Memoria anual de 1940 del Jefe del Departamento de investigaciónes de Algodón y cereales, Estación Experimental Agrícola de La Molina, Lima, Peru.** [Annual Report for 1940 of the Head of the Cotton and Agricultural Experimental Station of La Molina, Lima, Peru.]—30 pp., 71 graphs, [?1941. Received October, 1942. English summary.]

The following items of phytopathological interest occur in this report. During the season of 1939 to 1940 studies were conducted on 26 Tangüis cotton selections and the progenies of 378 plants phenotypically resistant to wilt (*Verticillium* sp.) [*R.A.M.*, xix, p. 212] from which 13 of the former and 61 of the latter, besides 202 phenotypically immune individuals, were reserved for further trials in connexion with the work of breeding for immunity from the disease. The average percentages of wilt in the selections and control variety (Hualcará, current season) at 93, 121, 155, 188, and 212 days were 6·81, 16·28, 21·01, 22·11 and 87·21, and 10·81, 29·40, 40·93, 44·29 and 92·29 respectively. In 1933–4 and 1937–8 the maximum incidence of wilt developed during a period extending from 100 to 140 days after sowing, when the optimum soil temperature (22° C.) for the growth of the pathogen at a depth of 5 cm. to 1 m. prevails. In 1938–9 and 1939–40 the selected strains were not attacked during the critical period, indicating an increase in genotypic resistance.

Progress is also reported in breeding wheat varieties resistant to black rust (*Puccinia graminis*), a limiting factor in the cultivation of the crop [ibid., xxi, p. 184].

STARR (M. P.) & BURKHOLDER (W. H.). **Lipolytic activity of phytopathogenic bacteria determined by means of spirit blue agar and its taxonomic significance.**—*Phytopathology*, xxxii, 7, pp. 598–604, 1942.

The writers describe and tabulate the results of their studies on the lipolytic properties of 65 phytopathogenic species and varieties of the genus *Phytomonas* Bergey *et al.* [*R.A.M.*, xxi, p. 364], 206 isolates of which were cultured on plates of spirit blue-cottonseed oil-tryptone yeast extract agar (*Science*, N.S., xciii, pp. 333–334, 1941). Of 24 members of the *Xanthomonas* [ibid., xviii, p. 659] group, 21 were found to be actively lipolytic, viz., *X. barbareae*, *X. begoniae*, *X. campestris* and its var. *armoraciae*, *X. corylina*, *X. geranii*, *X. gummisudans*, *X. holcicola*, *X. juglandis*, *X. papavericola*, *X. pelargonii*, *X. phaseoli* (some strains of which were over 15 years old) and its variants *fuscans* and *sojense*, *X. pruni*, *X. translucens* and its var. *undulosa*, *X. vasculorum*, *X. vesicatoria* and its var. *raphani*, and *X.* sp. from stock (*Matthiola incana*) [ibid., xviii, p. 257]. Lipolysis was effected, on the other hand, by only four of the 27 species of *Pseudomonas* tested, namely, *P. alliicola*, *P. caryophylli*, *P. marginata*, and *P. polycolor*, and by none of the 18 gall-forming organisms and related Rhizobiaceae. Slight or doubtful lipolytic activity was exerted by *Corynebacterium fascians*, but the other three species of this Gram-positive genus failed to decompose the lipoids in the medium, the same applying to the three representatives of the

Gram-negative *Phytomonas* [*X.*] *stewarti* group [cf. ibid., xxi, p. 282], except for weak capacity for lipolysis on the part of *P. manihotis* [ibid., xxi, p. 325]. The well-marked differences between the various groups in respect of their fat-splitting attributes should prove helpful in the relegation of individual species to their several genera.

GILL (L. S.). **Death in the desert.**—*Nat. Hist., N.Y.*, l, 1, pp. 23–26, 9 figs., 1942.

A semi-popular account is given of the researches now in progress, under the joint auspices of the University of Arizona (J. G. Brown), the Bureau of Plant Industry, and the United States Department of Agriculture, on the virulent stem rot [*Erwinia carnegieana*] of the giant cactus or saguaro (*Carnegiea gigantea*) in the Tucson and Phoenix districts [*R.A.M.*, xxi, p. 365], where mortality is heaviest in the 150- to 200-year-old age class. Since the trees contain over 90 per cent. water by weight, they are extremely resistant to heat and diseased material cannot be disposed of by burning; burial pits have therefore been dug for the accommodation of the dead trunks, which have to be sawn into short lengths (one of 5 ft. weighing 1,500 lb.) and transported by a portable crane. After fumigation the butt sections are treated with a volatile disinfectant and covered with tarpaulin for several days before the pits are closed with soil. Promising results have been given by excision of the infected tissues at an early stage.

MARCHIONATTO (J. B.). **Las enfermedades de las plantas cultivadas de la Argentina y sus problemas.** [The diseases of cultivated plants in the Argentine and the problems connected with them.]—*Chron. bot.*, vii, 4, pp. 163–164, 1942.

The author reviews the existing literature on diseases of economic plants in the Argentine and sums up the present plant disease situation as follows. Most diseases of cereals occurring in the country are being controlled by the introduction of resistant varieties. Thus, hybrid 38 M.A., Sinvalocho M.A., and other wheats resistant to *Puccinia triticina* [*R.A.M.*, xx, p. 9] are now used in place of Lin Calel M.A. There are no resistant varieties in the case of *P. graminis tritici* [ibid., xxi, p. 247], but some hardy ones, which escape infection in the humid region, where this disease is predominant. *P. glumarum* [ibid., xx, p. 9], which appeared relatively recently (1929), but in a very virulent form, necessitated the elimination of the susceptible variety Record, and its replacement by resistant varieties (Klein Acero and others) while additional varieties are being developed in collaboration with workers in both Americas. Wheat bunt, *Tilletia tritici* [*T. caries*] and *T. laevis* [*T. foetida*: ibid., xxi, p. 246], predominant in the semi-arid regions (south of Córdoba and Santa Fe), has been controlled by the dry method of seed-grain disinfection. In the control of *Ustilago tritici* on wheat, the generally recommended seed-grain disinfection can in practice be applied only on large farms provided with the necessary installations, and the use of resistant varieties, such as 38 M.A., is therefore recommended. It is suggested that studies on the antagonism between micro-organisms may reveal methods of controlling *Ophiobolus graminis* [loc. cit.] and *Helminthosporium sativum* on wheat, since crop rotation, as recommended at present, can only reduce, but not eliminate, these parasites. Most of the varieties of maize cultivated in the country are stated to be resistant to *U. zeae*, which is the most common disease of this crop. *U. hordei* [loc. cit.] and *U. nuda* attack barley with some frequency; the same methods of control are effective against them as against wheat bunt and loose smut. The development of resistant varieties is further important for the control of *H.* [*Pyrenophora*] *teres* on barley (the most common disease on this host and sometimes very destructive when occurring together with *H. sativum* and *H. gramineum* [loc. cit.]), *Puccinia coronata* on oats, *P. dispersa* [*P. secalina*] on rye, and *Piricularia oryzae* on rice. The last-named, though of recent appearance in

the country, has been very virulent in the northern rice-growing region (Salta and Tucumán).

Claasen (C. E.), Vogel (O. A.), & Gaines (E. F.). **The inheritance of reaction of Turkey–Florence–1 × Oro–1 to race 8 of Tilletia levis.**—*J. Amer. Soc. Agron.*, xxxiv, 8, pp. 687–694, 1 graph, 1942.

The $F_1$, $F_2$, and $F_3$ generations of crosses consisting of the three possible combinations of Oro–1, (Turkey–Florence)–1, and selection 9 of Oro × Turkey–Florence and six $F_4$ families of (T–F)–1 and Oro–1, chosen at random, were tested for their reaction to wheat bunt (*Tilletia levis*) [*T. foetida*] (race L–8) [*R.A.M.*, xvii, p. 381] under identical environmental conditions at the Washington Agricultural Experiment Station in 1939. Oro–1 is highly susceptible to the physiologic race used in the tests, while (T–F)–1 and selection 9 are both resistant. A major and at least one minor factor carried by (T–F)–1 appeared to account for the segregation of reaction of the cross between this variety and Oro–1. In the case of crosses between selection 9 and Oro–1 and (T–F)–1, the first-named carried only the major factor for resistance. The three parents represent three of the four homozygous genotypes possible under the two-factor hypothesis, the fourth being apparently typified by two $F_4$ families. Segregation of the major factor in combination with the minor homozygous resistant factor seems to have been attained in an $F_4$ family.

Kargopolova (Mme N. N.). Внутрисортовые скрещивания и повышение устойчивости яровых Пшениц к твердой головне. [Intravarietal crosses and the increased resistance of summer Wheats to bunt.]—*Яровизация* [*Vernalization*], iii (36), pp. 67–69, 3 graphs, 1941.

The results of experiments conducted near Leningrad during 1939 and 1940 showed that resistance to bunt [*Tilletia caries*: *R.A.M.*, xxi, p. 190] was greater in the $F_2$ progenies from crosses within a variety of wheat than in the progenies from selfed plants of the same variety. For example, 19·1 per cent. of the $F_2$ progenies from crosses within the variety Toulun ZA/32, were very resistant (0·1 to 5 per cent. infection), over 60 per cent. showed 0·1 to 15 per cent., and none over 40 per cent. while the corresponding figures for the selfed group were 1·8, 24, and 20 per cent., this last figure including plants showing up to 65 per cent. infection. In tests with the same variety during the following season, 52 per cent. of the $F_2$ progenies from crosses within the variety showed 0·1 to 40 per cent. infection, and 7·2 per cent. exhibited 60 to 64 per cent. infection, whereas 12 per cent. of the progenies from selfed plants showed 0·1 to 40 per cent. infection, and 42 per cent. exhibited 60 to 70 per cent. infection.

Hely (F. W.) & Ludbrook (W. V.). **The effects of sodium chloride and of two manganese salts on the growth of Wheat and its susceptibility to Ophiobolus graminis Sacc.**—*J. Coun. sci. industr. Res. Aust.*, xv, 2, pp. 124–128, 1 pl. (between pp. 184 and 185), 1942.

In a field experiment the growth of wheat (total dry weight of aerial parts shortly before maturity) was increased by soil treatment, before sowing, with potassium permanganate and decreased by sodium chloride. The difference between these treatments was significant, but the difference between them and the control was not. An application of manganous sulphate had no significant effect. When each of these treatments was applied to wheat inoculated with *Ophiobolus graminis*, the fungus significantly depressed growth, but no evidence was obtained of any interaction between the fungus and the salts.

In two experiments in containers, in two successive years, the pathogenicity of *O. graminis* to wheat was reduced by the addition to the soil of sodium chloride at a concentration injurious to the wheat.

Ludbrook (W. V.). **Root amputation experiments with Wheat under dry conditions, in relation to attack by Ophiobolus graminis.**—*J. Coun. sci. industr. Res. Aust.*, xv, 2, pp. 129–134, 1942.

At four stages of growth the root systems of Bencubbin wheat plants growing in the field near Canberra were injured experimentally by severing the subcrown internodes or by amputating the crown roots. The symptoms produced in the aerial parts by the former operation, and (though to a much smaller extent) by the latter, were indistinguishable from those seen on other plants in the same crop in which the subcrown internodes or seminal roots were rotted by natural infection with *Ophiobolus graminis*. The surface soil was very dry during the greater part of the growing period, and severing the subcrown internodes caused more damage at all stages of growth than amputation of the crown roots. It would, therefore, appear that when the surface soil is dry, the chief source of injury by *O. graminis* to wheat surviving the seedling stage may be want of the moisture which would be taken from the subsoil by the seminal root system, if not injured or destroyed by the fungus.

White (N. H.). **The genetics of Ophiobolus graminis Sacc. 1. Heritable variations for culture colour and pathogenicity.**—*J. Coun. sci. industr. Res. Aust.*, xv, 2, pp. 118–124, 3 pl. (between pp. 184 and 185), 1 fig., 1942.

To determine whether discontinuous variations in culture colour on potato dextrose agar and in pathogenicity on wheat observed by the author among isolations of *Ophiobolus graminis* were heritable, a genetic study of the fungus was made with reference to the characters for pathogenicity on a single wheat variety and to culture colour on potato dextrose agar.

Eight single-spore isolates from a single ascus fell into two colour groups, four of the isolates being pale and four dark. In the dark cultures the mycelium consisted of hyaline microhyphae and dark olivaceous macrohyphae, while in the pale cultures it consisted entirely of hyaline microhyphae. Of the dark cultures two were homotypes for aerial hyphae, and two for flat colony surface; of the pale cultures, two were homotypes for white aerial hyphae, and two for flat colony surface.

Each isolate was pathogenic to wheat, and according to the degree of pathogenicity shown there were two groups of four isolates, one severely, the other mildly, pathogenic. The former was characterized by the many plants killed by seedling blight and by the severe stunting of the survivors, while the yield was negligible; the latter was characterized by the relatively numerous plants that survived seedling blight and reached maturity, and by less stunting. When the test was repeated a year later, identical results were obtained.

The evidence demonstrated the presence of four phenotypes, two isolates belonging to each. These were (i) dark and mildly pathogenic, (ii) dark and severely pathogenic, (iii) pale and mildly pathogenic, and (iv) pale and severely pathogenic. Hence, the ascus contained four pairs of spores differing in character for pathogenicity and culture colour.

As the thallus of *O. graminis* is haploid, the effect of a single set of genes may be observed without the complications of dominance. The characteristics of each of the eight isolates, which were derived from a diploid primary ascus nucleus by reduction division, are due to a single set of genes. As there were four isolates of each of two phenotypes for colour and for pathogenicity, segregation occurred during ascosporogenesis, and the primary ascus was heterozygous. The production of four pairs of spores in one ascus suggests that segregation for one pair of factors occurred in the first division, and for the other pair in the second division of sporogenesis. This is explicable on the assumption that crossing-over of one pair of factors occurred at the pachytene stage in the first nuclear division. This resulted in one pair of factors segregating reductionally at the first meiotic division and the other pair of factors segregating equationally at the second meiotic division of the primary ascus.

The suggestion that characters for pathogenicity in *O. graminis* and other pathogenic ascomycetous fungi are Mendelian is supported by the fact that segregation for pathogenicity occurs during ascosporogenesis in *Venturia inaequalis*.

GLYNNE (MARY D.). **Cercosporella herpotrichoides Fron, causing eyespot of Wheat in Great Britain.**—*Ann. appl. Biol.*, xxix, 3, pp. 254–264, 1 pl., 1942.

Surveys of wheat crops in England in 1941 showed that when there is a high percentage of straw infection by *Cercosporella herpotrichoides* [*R.A.M.*, xx, pp. 295, 396; xxi, p. 124] the probability of general lodging in heavy crops is greatly increased. Individual straw lodging occurs in both light and heavy crops, the straws falling in all directions. The condition may, it is estimated, cause a reduction in grain yield of 30 per cent. A survey of 170 fields selected at random in 16 counties revealed that eye spot increased in frequency and severity as the fields were situated progressively further east; thus, in North Wales and the eastern counties (Lincolnshire, Cambridgeshire, and Norfolk) 3·6 and 84·5 per cent. of the fields, respectively, were affected, the corresponding figures for the areas lodged being 1·1 and 16·4 per cent., and for the areas of the district under wheat in 1939 0·17 and 12·89 per cent., respectively.

In three independent surveys 235 fields included 118 in which no barley or wheat had been grown for four years, and 37 of these showed infection, under 20 per cent. of the straws being infected in each field; there were 115 fields in which wheat or barley had been grown at least once in the preceding four years, and of these 89 showed infection, over half of them with more than 20 per cent. straw infection. Infections of over 20 and over 70 per cent. occurred in a few fields in which the last wheat or barley crop had been grown in 1937 or 1938, but such figures were most common where wheat or barley (or one of each) had been grown during at least two of the preceding four years.

It is concluded that eye spot will probably become more prevalent in wheat-growing areas under war-time conditions. Lengthening the rotation would reduce infection. If wheat is to be grown on land where severe infection has occurred, suitable preventive methods should be applied, including reduction of atmospheric moisture round the base of the plant, especially in spring by means of good drainage, thin sowing, wide spacing of rows, use of sparsely tillering varieties, and the checking of excessive spring growth. Short-strawed varieties might well be tried. Records should be made of the effects of these measures.

[A popular account of this disease, incorporating the results of investigations here recorded, is given by the author in *J. Minist. Agric., Lond.*, xlix, 2, pp. 91–94, 4 figs., 1942.]

NOVER (J.). **Untersuchungen über den Weizenmehltau, Erysiphe graminis tritici, im Rahmen der Resistenzzüchtung.** [Studies on Wheat mildew, *Erysiphe graminis tritici*, in relation to breeding for resistance.]—*Z. PflZücht.*, xxiv, p. 71, 1941. [Abs. in *Züchter*, xiv, 5, p. 125, 1942.]

At the Agricultural and Plant Breeding Institute, Halle, the writer carried out greenhouse inoculation experiments with two physiologic races of *Erysiphe graminis tritici* on over 800 varieties and selections of winter and summer wheat [*R.A.M.*, xix, p. 206]. Nearly all the winter types proved to be susceptible, with the exception of some individual plants from collections made by the German Hindu Kush expedition, but there was a higher incidence of resistance among the summer wheats, both indigenous and exotic. The results of tests on an assortment of 16 varieties with 'populations' of 50 German mildew collections revealed that in 22 'populations' a single physiologic race predominated. Field observations pointed to the gradual acquisition with advancing maturity of resistance to certain races of the pathogen in some varieties irrespective of the reactions displayed in the seedling stage, while a form of field resistance evidently conditioned by environmental factors was also

noticed. In hybridization trials resistance proved to be dominant: of six crosses, two (with the resistant Dixon C.I. 6295) segregated on a definitely monomerous basis in the $F_2$, while the other four (with Illinois No. 1 selection 47 and Normandie) segregated in the ratio of 4 to 6·5 resistant : 1 susceptible.

BEVER (W. M.). **A nonpathogenic buff-coloured Barley smut.**—*Phytopathology*, xxxii, 7, pp. 637–639, 1 fig., 1942.

In September, 1936, in connexion with a study at the Idaho Agricultural Experiment Station of the genetics of hybrids between a physiologic race of *Ustilago hordei* and two of *U. nigra*, $F_1$ chlamydospores were obtained on Odessa barley (C.I. 934) from infection with paired monosporidial lines of the two smuts, and used, together with those of subsequent generations, for the reinoculation of seed of the Nepal (C.I. 595), Lion (C.I. 923), and Himalaya (C.I. 1312) varieties. One plant of the first-named bore two identical buff-smutted heads containing $F_3$ chlamydospores, which were hyaline, glabrous, and intermediate in size between *U. hordei* and *U. nigra*, the sporidia being long, narrow, rather pointed, and smaller than those of either of the parent smuts, though approximating more closely to the latter. Spore germination was irregular, two or three firmly adhering sporidia on a promycelium, instead of the normal four, being of fairly common occurrence. Sporidial fusion in culture disclosed the existence of two sex groups [*R.A.M.*, xiv, p. 353], but no infection was produced on the Nepal or Odessa variety by inoculation with chlamydospores or paired monosporidial lines, suggesting that sex and pathogenicity are governed by different factors.

**Science for the farmer.**—*Rep. Pa agric. Exp. Sta. 1940–41* (*Bull.* 414), 63 pp., 19 figs., 3 graphs, 1941.

On p. 13 of this report [cf. *R.A.M.*, xx, p. 104] it is stated that as a result of steadily increasing popularity following trial distribution, the 90A–27 oat strain, which is resistant to smut [*Ustilago avenae* and *U. kolleri*: ibid., xxi, pp. 329, 367], has been released for certification. Some 3,000 acres of this strain were grown in Pennsylvania in 1940, and no severe criticism was received. It is high-yielding under the conditions prevailing in the central parts of the State, and very resistant to smut.

HAGEMAN (R. H.), MCHARGUE (J. S.), SHERMAN (G. D.), & HODGE (E. S.). **The production of grey speck of Oats in purified sand cultures.**—*J. Amer. Soc. Agron.*, xxxiv, 8, pp. 731–735, 1 fig., 1942.

At the Kentucky Agricultural Experiment Station typical grey speck developed in the very susceptible Wolverine variety [*R.A.M.*, xxi, p. 193] growing in a sand culture devoid of manganese, but there was a sufficiency of this element in the chemicals composing the unpurified 'three-salt solution' (*Plant Physiol.*, xv, pp. 727–733, 1940) to prevent the development of the disease in an acute form, while culture solutions containing 2 p.p.m. manganese supported normal growth.

KERNKAMP (M. F.) **The relative effect of environmental and genetic factors on growth types of Ustilago zeae.**—*Phytopathology*, xxxii, 7, pp. 554–567, 1942.

Further studies at the Minnesota Agricultural Experiment Station on the relative effects of environmental and genetic factors on the three growth types of maize smut (*Ustilago zeae*) [*R.A.M.*, xviii, p. 670] confirmed previous conclusions, namely, that the specifically sporidial and mycelial lines are unalterably fixed, whereas those of intermediate tendency may be shifted in one direction or the other by various external stimuli, of which dextrose (100 gm. per l.) was the most effective in the production of sporidia, while mycelial development was favoured by conditions repressive to the growth of the organism, e.g., the addition to the medium of poisons (mercuric chloride, copper sulphate, lead acetate, and iron chloride) or toxic dyes (including

malachite green), low concentrations of essential nutrients, and a reduction in the amount of oxygen in the atmosphere. Grown on extracts of 'natural' substrata, i.e., soil, silage, manure, and maize, the intermediate lines also tended to assume a predominantly mycelial character, probably reflecting the normal course pursued by the smut in the field.

MOULTON (J. E.). **Extraction of auxin from Maize, from smut tumors of Maize, and from Ustilago zeae.**—*Bot. Gaz.*, ciii, 4, pp. 725–739, 1942.

In experiments in the extraction of auxin from smut (*Ustilago zeae*) tumours of maize, water extraction yielded more auxin than ether. Dry ether extracts were inactive. For the liberation of auxin from the tumour tissues water is necessary, its action, possibly, being hydrolytic. The maize tumours yielded auxin slowly with either water or ether extraction, whereas the auxin was almost entirely removed from mats of the fungus itself in one ether extraction. Tumours from maize leaves and stems gave more auxin than healthy leaves and stems. Strains of *U. zeae* grown on a synthetic medium devoid of protein and amino acids produced auxin. Extracts of organic and inorganic types of medium upon which the fungus had grown for two months contained much auxin, the amount being virtually the same for each type of medium. Solopathogenic strains of *U. zeae* [cf. *R.A.M.*, xix, p. 528], except in one case, produced more auxin than non-solopathogenic strains, and the pathogenicity of strains would appear to be correlated with ability to produce auxin in a lacto-tryptone or synthetic medium.

LINCOLN (R. E.) & GOWEN (J. W.). **Mutation of Phytomonas stewartii by X-ray irradiation.**—*Genetics*, xxvii, 4, pp. 441–462, 2 pl., 1942.

At the Iowa Agricultural Experiment Station the writers conducted a comparative study of the mutations occurring in two strains, rough and smooth, of *Phytomonas* [*Xanthomonas*] *stewarti* [*R.A.M.*, xix, p. 468], the agent of vascular wilt in maize, under natural conditions and as a response to the stimulus of X irradiation of low quantum energy, operating at an intensity such that 100,000,000 viable cells suspended in broth were reduced to 1,000 during a 25-minute treatment. Variations were observed in colony colour, surface appearance, and size, the spontaneous and X-ray-induced mutations differing only in the greater frequency of the latter. The modifications of colony characters under observation may be either more or less pathogenic to maize than the parent strains. Apart from mutations to an unstable form, the mutants developing in these experiments were apparently equally stable with the parent strains from which they proceeded. The terms 'mutant', 'variant', 'saltant', and 'dissociant', as applied to bacteria, are regarded as synonyms descriptive of the phenomena resulting from gene mutation, the physical basis of inheritance being similar in *X. stewarti* to that of higher organisms.

MELCHERS (L. E.). **On the cause of the Milo disease.**—*Phytopathology*, xxxii, 7, pp. 640–641, 1942.

Recent studies at the Kansas Agricultural Experiment Station, carried out with the aid of D. B. Creager and C. M. Slagg, have shown that the root, crown, and shoot rot of milo sorghum commonly ascribed to *Pythium arrhenomanes* [*R.A.M.*, xx, p. 298] is actually due to a more complex set of factors to be discussed in detail in another paper. The fungus is equally virulent on susceptible strains of milo and on those known to be resistant to the root rot, and moreover, neither seedlings nor older plants grown in sterile or non-sterile soil containing pure cultures of the organism contracted the typical symptoms of the disease. It is thus evident that other micro-organisms, environmental conditions, or contributory factors must be involved in the etiology of the milo rot.

Cowart (F. F.). **The effect of magnesium deficiency in Grapefruit trees upon the composition of fruit.**—*Proc. Amer. Soc. hort. Sci.*, xl, pp. 161–164, 1942.

In field experiments with Duncan and March grapefruit trees exhibiting severe magnesium deficiency [*R.A.M.*, xx, p. 461], started in Florida in 1937, plots receiving a fertilizer containing no magnesium continued to show severe symptoms, those treated with fertilizer containing 2 per cent. magnesium oxide from magnesium sulphate showed only slight symptoms, while the addition of 4 per cent. magnesium oxide induced complete recovery. Analyses of fruits from all three plots showed that those from plots with no symptoms have the highest content of total soluble solids and sugars, vitamin C, and citric acid, while those from plots with the most severe symptoms have the lowest. The differences were slightly less pronounced during the early part of the season than at later dates. It is concluded from these data that a magnesium deficiency in grapefruit leads to a shortage of those components which are to a large extent responsible for the internal quality of the fruit. The improvement in internal quality of the fruit following the application of fertilizers containing magnesium is attributed to the great increase in leaf area and general efficiency of the foliage on these trees.

Averna-Saccá (R.). **Contribuição para o estudo das doenças cryptogâmicas das plantas cítricas. Uma gommose produzida por Dothiorella.** [A contribution to the study of the fungal diseases of Citrus plants. A gummosis caused by *Dothiorella*.]—*Rev. Agric., Piracicaba*, xiii, 3–4, 22 pp., 13 figs. (2 col.), 1938. [Received October, 1942.]

This is a detailed study of the morphological and cultural characters of *Botryosphaeria* (*Dothiorella*) *ribis*, the agent of a serious die-back and gummosis of citrus in São Paulo, Brazil, where the more susceptible species include Galician and sweet (*Citrus lumia*) lemons [*R.A.M.*, xix, p. 659], citron, Persian and Navel limes (*C. bergamia* and *C. limetta*), and Coronel and Pear oranges (*C. corniculata* and *C. piriforme*) [ibid., xvii, p. 171], bitter and Satsuma oranges and tangerines being semi-immune.

Lepesme (P.). **Ennemis et maladies du Caféier en Afrique intertropicale. Diagnose pratique et moyens de lutte.** [Pests and diseases of Coffee in intertropical Africa. Practical diagnosis and control measures.]—63 pp., 39 figs., Paris, Larose, 1941. [Abs. in *Z. PflKrankh.*, lii, 6, p. 317, 1942.]

This treatise deals primarily with the diseases of the coffee crop in French Equatorial Africa and the Cameroons, the subject-matter being arranged under the various organs of the host. The diseases are in the main identical with those occurring in other parts of tropical Africa, but the approach to control problems is somewhat different in the west, where prophylactic treatments with Bordeaux mixture against *Hemileia vastatrix*, for instance, are recommended at the beginning and end of the rainy season. A separate section is devoted to indirect control by means of cultural measures, based on personal experience.

Neal (D. C.) **Rhizoctonia infection of Cotton and symptoms accompanying the disease in plants beyond the seedling stage.**—*Phytopathology*, xxxii, 7, p. 641, 1942.

An uncommon phase of the cotton damping-off due to *Rhizoctonia* (*Corticium vagum*) [*C. solani*] was noted in the Louisiana Delta in 1940 and 1941. Many of the plants in the early flowering stage, 7 to 14 in. high, were almost devoid of lateral roots, semi-prostrate, and with few fruiting branches. The stems bore deep-seated cankers above and below the soil-line, and many showed characteristic constrictions almost severing the stems just beneath the surface. About 90 per cent. of the cultures from infected tissues yielded *C. solani*. In cold, wet spring weather, therefore, the

disease, which is ordinarily confined to early-planted cotton seedlings, may persist sufficiently late to cause appreciable damage to older plants.

DASTUR (J. F.). **Effect of Cotton seed disinfection on yield.**—*Indian J. agric. Sci.*, xii, 2, pp. 364–367, 1942.

In experiments conducted during the five-year period from 1936 to 1941 at Nagpur to determine the effect on yield of cotton seed disinfection against *Pythium* sp., *Rhizoctonia* [*Corticium*] *solani* [*R.A.M*, xxi, p. 450], *R.* sp., *Sclerotium rolfsii*, and *Colletotrichum indicum* [ibid., xx, p. 149], the following percentage increases of production resulting from treatment were recorded: agrosan G from 1·7 to 38·3, hortosan B [ibid., xviii, p. 373] from 9·1 to 44·6, abavit B, from 5·9 to 40·3, ceresan from 16·3 to 25·9, copper carbonate from 8·2 to 38·9, sulphur from 12·4 to 33·7, and sulphuric acid for delinting from 8·7 to 10·4, the first three being used at the rate of 1 oz. per 28 lb., the next two at 2 oz., and the last at 20 parts by volume. Ceresan not being on the Indian market, and the delinting process impracticable for the ordinary cultivator, these two modes of treatment were discontinued after 1939. In further trials at various localities from 1939 to 1941, agrosan G induced increased yields ranging from 2 to 31·2 per cent., copper carbonate from 4·7 to 19·0, and sulphur from 1·9 to 32·5. In spite of certain inconsistencies in the results, the fungicidal treatment of cotton seed may be recommended as calculated to stimulate germination and ensure a reduction in the incidence of loss from disease.

PARKIN (E. A.). **Symbiosis and Siricid woodwasps.**—*Ann. appl. Biol.*, xxix, 3, pp. 268–274, 2 figs., 1942.

A study of the association between the woodwasps *Sirex gigas* and *S. cyaneus* and the fungi with which they live in symbiosis [*R.A.M.*, xix, p. 213] demonstrated that one species only, *Stereum sanguinolentum*, is present in the intersegmental sacs at the anterior end of the ovipositor of adult females. The egg becomes infected with oidia at the beginning of its passage down the ovipositor, and when it has been deposited in timber, mycelial growth begins. The fungus passes into the wood before the larva, which is probably mycetophagous, at least to some extent. The hypopleural organs, found in a proportion of the larvae, also contain the same fungus. No fungus was observed in pupae, and it is thought that *S. sanguinolentum* must grow from the walls of the pupal chamber into the intersegmental sacs of the immature female immediately after emergence from the pupal skin.

DESFORGES (A.). **Mycoses des pieds (pieds d'athlète): diagnostic et traitement.** [Mycoses of the feet (athlete's foot): diagnosis and treatment.]—*Un. méd. Can.*, lxxi, 9, pp. 940–941, 1942.

'Athlete's foot', without doubt the commonest skin disorder in the United States [*R.A.M.*, viii, p. 781 *et passim*], is stated to be equally prevalent in Canada, where it is attributable to *Epidermophyton inguinale* [*E. floccosum*].

KOERTH (C. J.), McCORKLE (R. G.), & DONALDSON (J. M.). **Fungus diseases of the lung.**—*Tex. St. J. Med.*, xxxviii, 1, pp. 8–14, 12 figs., 1942.

Attention is drawn to the risks of insufficient evidence for the diagnosis of pulmonary tuberculosis, which is frequently simulated by such mycotic infections of the lung as bronchomoniliasis, actinomycosis, and aspergillosis. In the four cases reported from the Woodmen of the World Hospital, San Antonio, Texas, species of *Actinomyces*, *Aspergillus*, *Monilia* [*Candida*] *tropicalis*, and possibly *M. candida* [*C. vulgaris*] were cultured from the sputum.

NOTTEBOHM (T.) & NEGRONI (P.). **Queilitis por Candida suaveolens [(Lindner) Ciferri].** [Cheilitis due to *Candida suaveolens* (Lindner) Ciferri.]—*Rev. argent. Dermatosif.*, xxiv, 3, pp. 294–298, 1 fig., 1940. [French and English summaries.]

A fungus isolated on Sabouraud's media from the scales of labial cheilitis in a 21-year-old male patient was classified as *Candida suaveolens* (Lindner) Ciferri, although it differed from Langeron and Guerra's description [*R.A.M.*, xviii, p. 253] in its negative auxanograms for lactose, urea, and ammonium sulphate. The organism multiplies exclusively by budding, the cells being globular, oval, or elongated, and measuring on the 45th day in liquid beerwort 3·7 by 2·8 to 9·3 by 9·3 and 9·3 by 3·7 $\mu$. The auxanograms for glucose, galactose, maltose, lactose, saccharose, raffinose, and peptone were positive.

MIDDLETON (J. T.), TUCKER (C. M.), & TOMPKINS (C. M.). **Pythium disease of fibrous-rooted Begonia and its control.**—*J. agric. Res.*, lxv, 2, pp. 89–95, 2 figs., 1942.

This is an expanded account of a disease of fibrous-rooted begonia, caused by *Pythium debaryanum*, *P. ultimum*. and *P. splendens* in California and Missouri, of which a short version has already been noticed [*R.A.M.*, xviii, p. 113]. In potted plants the disease was found to be favoured by excessive watering, particularly when the water was sprinkled, and by a temperature range of between 60° and 70° F. The minimum, optimum, and maximum temperatures for growth were found to be 4°, 28° to 31°, and 37°, respectively, for *P. debaryanum*; 10°, 28° to 31°, and 34° for *P. splendens*; and 4°, 25° to 28°, and 37° for *P. ultimum*. The last-named fungus proved to be pathogenic to spinach, sweet william, rocket larkspur (*Delphinium ajacis*), cauliflower, *Reseda odorata*, *Godetia grandiflora*, *Schizanthus pinnatus*, and cucumber, but not to the other 34 species of test plants, belonging to 32 genera in 19 families. Pure cultures of all three fungi caused approximately 90 per cent. damping-off in potted tomatoes when added to the sterile soil in which they were sown. It is suggested that the disease can be controlled in the greenhouse by steam sterilization of the flats and soil and by proper spacing and careful watering of the plants, while after transplantation out of doors, the degree of new infection can be materially lowered by keeping the plants relatively dry. One pink-flowering hybrid, for which the name Calmo is proposed, was found in repeated experiments to be immune from *P. ultimum* in the open as well as in the greenhouse.

LANGDON (R. F.). **The genus Cerebella Cesati—its biological status and use.**—*Phytopathology*, xxxii, 7, pp. 613–617, 1942.

Following a brief survey of the literature on the genus *Cerebella* Cesati 1851, the writer states that since May, 1940, collections of *C. inquinans* have been made on 13 species of grass in south-eastern Queensland, always in association with numerous *Claviceps* conidia [*R.A.M.*, xxi, p. 81]. *Cerebella inquinans* was isolated from the spikelets of each of the hosts and cultured on potato dextrose agar, on which the characteristic cerebriform stroma of the genus develops in a few days; potato slices or potato agar with sucrose, glucose, or honey were also suitable media for spore production by the fungus. The inoculation of *Paspalum dilatatum* and *P. orbiculare* with a spore suspension of *C. inquinans* alone gave negative results, but the former host responded to artificial infection with a mixture of conidia of *C. inquinans* and *Claviceps paspali* [ibid., xxi, p. 452] by the production of an exudate of honey-dew in a week, the typical stromata of *C. inquinans* appearing two to three days later on the ergotized spikelets. These results, taken in conjunction with those reported by previous workers, indicate that species of *Cerebella* occur merely as saprophytes on any substratum rich in carbohydrates, notably the honey-dew secretions associated with the *Sphacelia* stage of *Claviceps* spp.

Four points arise from these supplementary data on the relationship between *Cerebella* and its hosts, namely, (1) the substitution of *Sphacelia* for *Cerebella* in host

indexes and a search made for the species of *Claviceps* involved in each case. (2) *Cerebella* provides for the natural control of ergot by the inhibition of sclerotial development. (3) It serves as a reliable field indicator of the presence of ergot. (4) The history of ergot in a country may be traced through records of *Cerebella* on grasses. The need for a revision of the genus is stressed.

Albrecht (H.). **Effect of diseases upon survival of White Clover, Trifolium repens L., in Alabama.**—*J. Amer. Soc. Agron.*, xxxiv, 8, pp. 725–730, 3 figs., 1942.

In a study at the Alabama Agricultural Experiment Station and elsewhere in the State from 1940 to 1942 on the effect of diseases on the capacity of white clover (*Trifolium repens*) to survive the extreme heat of summer, southern blight (*Sclerotium rolfsii*) was found to be much the most destructive of the ten pathogens (including the nematode, *Heterodera radicicola* [*H. marioni*]), so far investigated, attacking 481 of the 750 lines under observation in 1940, and 202 out of 277 in 1942, Ladino and other varieties of similar root and stem habit being particularly susceptible. Other fungi causing heavy damage to the leaves were *Stagonospora meliloti* [*R.A.M.*, xxi, p. 22] and a species of *Cercospora*, while the other organisms present included *Polythrincium* [*Dothidella* or *Cymadothea*] *trifolii* [loc. cit.], *Botrytis* sp., *Sclerotinia trifoliorum*, *Bacillus* [*Erwinia*] *lathyri*, *Colletotrichum trifolii*, and *Fusarium* sp. In many cases the plants were attacked simultaneously by more than one pathogen: of the 750 examined in 1940, for instance, 130 were infected by two, 275 by three, 282 by four, and 39 by five. A number of clover strains (38 in the case of *Sclerotium rolfsii*) have given promise of resistance to the various diseases enumerated, most of which reached a climax of virulence after mid-June, when the main crop had attained maturity. The strands in over-grazed or sparsely vegetated pastures were much less subject to disease than those in sites of abundant growth.

Blaser (R. E.) & Stokes (W. E.). **The chemical composition, growth, and certain deficiency symptoms of Carpet Grass, Axonopus affinis, as affected by lime and fertilizer mixtures.**—*J. Amer. Soc. Agron.*, xxxiv, 8, pp. 765–768, 2 figs., 1942.

The omission of phosphorus from the lime and fertilizer mixture applied to plots of carpet grass (*Axonopus affinis*) in the Coastal Plain of Florida led to the development of a dull green to purplish coloration of the plants. Burning of the blade tips was a feature of stands from which potassium was withheld.

Carlson (J. W.). **Seed of new wilt-resistant winter hardy Alfalfa to be increased for general distribution.**—*Fm Home Sci., Utah,* ii, 4, pp. 1, 11, 1 fig., 1941.

The Utah Agricultural Experiment Station has entered into a co-operative agreement with the Utah Crop Improvement Association for the production of certified seed of high quality of various important field crops. As part of this programme the Utah Station, the Division of Forage Crops and Diseases of the United States Department of Agriculture, and the Wisconsin Agricultural Experiment Station are co-operating in a special effort to produce foundation seed stocks of lucerne possessing confirmed resistance to bacterial wilt [*Corynebacterium insidiosum*: *R.A.M.*, xx, pp. 345, 535; xxi, p. 121], increased winter-hardiness, and other desirable qualities.

Small, well-isolated plots are established from a few ounces of seed obtained from highly improved plants grown under greenhouse conditions. The seed, treated with concentrated sulphuric acid, is planted in the greenhouse or cold frame, where the seedlings are maintained under optimum conditions until they are about six weeks old. The best isolation for small plots is in small towns, where little lucerne is grown; larger plots are isolated in dry regions where wheat is the major crop and much of the soil is still uncultivated. By these methods and careful insect control, the seed of the new strains has been increased from a few ounces in spring to as much as 50 lb. by the autumn. Trial plots are then set up with this seed in many States,

where the new strains are studied; those that pass these tests are recommended for trial in commercial plantings.

PETERSON (M. L.) & MELCHERS (L. E.). **Studies on black stem of Alfalfa caused by Ascochyta imperfecta.**—*Phytopathology*, xxxii, 7, pp. 590–597, 2 figs., 1 graph, 1942.

A number of different fungi having been implicated in the etiology of black stem of lucerne, studies were carried out on the origin of the disease as it occurs in Kansas, where the causal organism was identified as *Ascochyta imperfecta* [*R.A.M.*, xxi, p. 336], the pycnospores of which on potato dextrose agar ranged from 6 to 15 by 2·5 to 4 $\mu$, thus agreeing with the dimensions previously reported by Peck (*Bull. N.Y. St. Mus.* 157, 1912) and by Toovey *et al.* from England [*R.A.M.*, xvi, p. 258]. The pathogen, which probably overwinters in the form of dormant mycelium and pycnidia in the crop refuse, induces destructive defoliation and discoloration of the hay crop, especially under the cool, moist conditions prevailing at the time of the first cutting. In the field infection is disseminated by means of splashing raindrops, within which the spores are conveyed from the diseased tissues to the growing shoots. The optimum temperature for the growth of *A. imperfecta* in culture was 21° C., the minimum and maximum being 9° and 33°, respectively; pycnidial production took place from 9° to 30° and was most abundant at 27°. Spore suspensions from sterile sweet clover (*Melilotus*) stems were sprayed on to healthy Turkestan and Ladak lucerne leaves with positive results, the severity of the resultant lesions being independent of the age of the plants. *Medicago falcata* and *M. ruthenica* were added to the list of hosts of *A. imperfecta*.

MEIER (K.). **Über Gelbsucht an Obstbäumen, Reben und Gartenpflanzen.** [On chlorosis of fruit trees, vines, and horticultural plants.]—*Schweiz. Z. Obst.- u. Weinb.*, li, 18, pp. 357–361, 1942.

The complex of adverse environmental factors inducing chlorosis of fruit trees, vines, and horticultural plants, many specimens of which are submitted to the Wädenswil Experiment Station for advice, are discussed under various headings, including soil deficiencies, especially of nitrogen and potash, unfavourable physical structure of the soil associated with waterlogging, defective aeration, and other factors, and unduly low winter and spring temperatures.

BURRELL (A. B.) & CAIN (J. C.). **A response of Apple trees to potash in the Champlain Valley of New York.**—*Proc. Amer. Soc. hort. Sci.*, xxxviii, pp. 1–7, 1941.

BURRELL (A. B.), CAIN (J. C.), & BRINKERHOFF (L. A.). **Response of Apple trees to potash in the Champlain Valley. II. A third-year growth response and a first-year reduction in leaf scorch.**—ibid., xl, pp. 8–12, 1942.

For 14 years leaf scorch [*R.A.M.*, xx, p. 478] and an unthrifty condition of trees resembling potassium deficiency has been observed in certain apple orchards in the Champlain Valley, New York State. Yearly applications of potassium to McIntosh apple trees gave the following results. In the first experiment commenced in 1939 on nine-year-old trees growing in rather infertile soil, applications of either 3 lb. sulphate of potash or 1½ lb. each of sulphate and muriate of potash per tree in a foot-wide trench round the tree induced no response in the first year, a conspicuous reduction of leaf scorch in the second, and merely a trace of the disorder as compared with 64 per cent. on the controls in the third, when the average growth per terminal was 11 as compared with 4 in., the average total terminal growth per tree 1,477 as compared with 494 in., and the potassium content of the leaves 1·76 per cent. as compared with 0·70. In a second experiment commenced in 1938 with seven-year-old trees grown in rather less infertile soil, soil applications of either 5 or 2 lb. muriate of

potash or 3 lb. sulphate of potash in either holes or bands about 2 ft. from the tree induced no response until the third year, when leaf scorch was entirely controlled, the potassium content of treated leaves being increased by more than 200 per cent. over that of untreated. In a third experiment commenced in 1941, mostly with six-year-old trees grown in relatively fertile soil, applications of sulphate of potash at the rate of 3 lb., muriate of potash at that of 2 lb. 6 oz. per tree, or a 1 per cent. sulphate of potash spray caused a response to all treatments within two months. The spray treatment appeared to give more rapid control, but this superiority was not maintained throughout the summer. The reduction in leaf scorch 3½ months after treatment ranged from 33 to 49 as against 6 per cent. in the untreated trees; the potassium content of leaves was raised by soil applications to from four to six times that of the control, and by spraying to from two to three times. Although the spray treatment is effective, it may prove costly and possibly lead to foliage injury from reaction products with arsenicals or lime-sulphur.

Batjer (L. P.) & Haller (M. H.). **Fruit maturity and growth of Apple trees as affected by boron content. (Preliminary report.)**—*Proc. Amer. Soc. hort. Sci.*, xl, pp. 29–30, 1942.

This is a preliminary report on experiments carried out during 1940 in which soil applications of borax (at the rate of ⅓ lb. to 8-year-old and 1 lb. to 20-year-old trees) were made three weeks prior to blossoming to Jonathan, Delicious, Rome Beauty, Grimes Golden, and York Imperial apple trees growing in soil relatively low in available boron, but showing no definite symptoms of boron deficiency. The results showed no measurable effect on the growth of the trees after two seasons. The boron content of leaves and fruits of the treated trees averaged 45 and 50 parts per million, respectively, as compared with 30 and 13 p.p.m. for the untreated controls. Generally speaking, the treated trees showed more pre-harvest drop (23 to 45 per cent. as compared with 6 to 12 in the control), developed colour earlier, and produced a greater amount of breakdown and less scald in storage than the untreated ones, indicating that the borax treatment had advanced maturity.

Heinicke (A. J.), Reuther (W.), & Cain (J. C.). **Influence of boron application on preharvest drop of McIntosh Apples.**—*Proc. Amer. Soc. hort. Sci.*, xl, pp. 31–34, 1942.

Soil applications of borax at the rate of ½ lb. per tree were given in 1940 to a 20-year-old block of 90 vigorous McIntosh apple trees in the Cornell University orchard at Ithaca, New York. The soil in this block had received unusually heavy nitrogen fertilization during the ten preceding years, but was low in available boron; the trees had suffered since 1934 from a heavier pre-harvest drop [cf. preceding abstract] than those in other parts of the orchard, the first definite symptoms of boron deficiency appearing in the spring of 1940. The applications resulted in 1941, when no external sign of boron deficiency was apparent, in a reduction in the pre-harvest drop (from 497 and 649 dropped fruits in two control trees to 62 and 99 in the treated trees) and in the drop through harvest (from 70 and 87 to 43 and 36 per cent. of the total yield) on trees which had previously exhibited severe external cork, but there was no definite effect in those free from cork. Analyses of the leaf tissue showed that the borax treatment reduced the drop even though there was not always an accompanying increase in the boron content of the leaf. The results of these experiments are taken to indicate that an excessive pre-harvest drop of fruit may be associated with incipient stages of boron deficiency which may not be severe enough to cause cork or drought spot.

Christopher (E. P.). **A comparison of lime sulphur and flotation sulphur spray on Apple trees.**—*Proc. Amer. Soc. hort. Sci.*, xl, pp. 63–67, 2 figs., 1942.

Comparative tests of lime-sulphur (1 in 50) and a flotation sulphur paste (10 lb. to 100 gals.) sprays on both mature and young McIntosh, Rhode Island Greening, and Baldwin apple trees, conducted at the Rhode Island Agricultural Experiment Station since 1936, showed that of the two materials lime-sulphur caused the greater reduction in carbon dioxide assimilation in the leaves (35 as compared with 18 per cent.) and the more severe leaf damage (15·74 and 25·99 per cent. of the leaf area injured as compared with 8·72 and 3·68), permitted less tree growth (1·87 and 1·93 in. trunk diameter as compared with 2·07 and 2·19), gave the smaller yields (mean total for six years of 78·0 and 29·4 bush. as compared with 116·5 and 66·2), and the smaller accumulations of starch in stored apples (13 per cent. of the pith area filled with starch grains as compared with 32). It is concluded that on account of its superiority flotation sulphur should be used instead of lime-sulphur.

Hildebrand (E. M.) & Hough (L. F.). **Pollenicides as supplements for bactericides in blossom blight control.**—*Proc. Amer. Soc. hort. Sci.*, xl, pp. 91–94, 1942.

In continued studies on the pollenicidal action of certain bactericides on apple trees [*R.A.M.*, xix, p. 658], elgetol and a new material, nitrokleenup powder, were both found in the laboratory to inhibit all pollen germination on agar at a dilution of 0·0001, whereas at dilutions as strong as 0·02 they were still only weakly bactericidal. In orchard trials spraying 10-year-old Rhode Island Greening apple trees with a 0·1 per cent. concentration of nitrokleenup, applied thoroughly with a knapsack sprayer at the time of pollination or 24 hours after, resulted in 20·2 and 15·5 per cent. of set fruits, respectively, as against 42·6 per cent. in the unsprayed trees, or 38·4 and 31·1 in the trees sprayed 48 and 72 hours after pollination, respectively. The only injury caused by spraying with this material consisted in a slight crinkling of the leaves. In the light of published and unpublished data on elgetol and the authors' own field work [the results of which were rendered inconclusive by frost], it is considered that this material is even more promising for fruit thinning, which, it is suggested, might help to control the blossom-blight phase of fire blight (*Erwinia amylovora*) by removing the late-opening blossoms. Further studies are in progress.

Allen (F. W.). **Carbon dioxide storage for Yellow Newtown Apples.**—*Proc. Amer. Soc. hort. Sci.*, xl, pp. 193–200, 1942.

In extensive commercial trials from 1938 to 1940 Yellow Newtown apples stored at 42° F. in a 6 per cent. concentration of carbon dioxide developed no internal browning (as compared with an average of 48 per cent. in air storage at 36°), and only a slight amount of incipient scald [*R.A.M.*, xxi, p. 82] in 4 out of 12 lots of unwrapped fruit. It is suggested that the absence of internal browning in carbon dioxide storage is due indirectly to the gas, which permits the use of temperatures above those employed in air storage, that is, temperatures above 40°, at and above which this disorder no longer occurs. Pre-storing for 15 days at 40° in relatively high concentrations of carbon dioxide appeared to be without effect on the subsequent development of internal browning in air storage at 32° or 36°, although it was materially more severe at the lower temperature.

Singh (U. B.). **Stem-brown disease of Apple in Kumaun.**—*Indian J. agric. Sci.*, xii, 2, pp. 368–380, 5 pl., 1942.

The fungus responsible for the stem-brown disease of apples, first observed in India at the Government Orchard, Chaubattia, Kumaun, United Provinces, in August, 1934, was identified by S. F. Ashby as *Botryosphaeria ribis*, infection by which usually originates on the pruned surfaces of twigs and stems and proceeds

downwards, causing a type of die-back [cf. *R.A.M.*, xvii, p. 755], the upper limbs being chiefly involved. The bark becomes loose and rolls outwards, turning brown and assuming a papery consistency, and the decorticated wood shows a dark brown discoloration with horizontal and longitudinal fissures. *B. ribis* is often found in association with *Coniothecium chomatosporum* [ibid., xx, p. 290] in the cankered areas. The symptoms of stem-brown are usually noticeable by the fourth week of April and reach a climax in the middle of May. Perithecia are rarely observed in nature. Detailed descriptions of all stages of the fungus are given.

After a month's immersion in snow diseased apple twigs bearing pycnidia, on examination in March, showed the presence of perithecia, the role of which in the spread of the pathogen has not been determined. It is clear, however, that over-wintered material of this description is likely to provide a fresh source of inoculum for the coming season. Wounded and uninjured Esopus Spitzenberg twigs reacted to inoculation with the fungus by the development of typical bark symptoms and the production of B-type pycnidia, perithecia developing in the following year. The progress of infection was uniformly very slow. Cross-inoculation experiments with a mono-pycnospore isolation on cut pear, peach, apricot, and chestnut twigs [ibid., iii, p. 725] gave positive results.

The principal sources of the fresh infections occurring in nature from May to July are the pycnidia and, to a lesser extent, water-borne ascospores. Effective control may be secured by the application to the pruned stem surfaces of a paste consisting of equal amounts of red lead and copper carbonate in lanoline, the last-named being preferable for the purpose in view to the raw linseed oil used by Dey and Singh with the same fungicidal mixture against *C. chomatosporum* [ibid., xx, p. 290].

English (W. H.). **Taxonomic and pathogenicity studies of the fungi which cause decay of Pears in Washington.**—*Res. Stud. St. Coll. Wash.*, viii, 3, pp. 127–128, 1940. [Received September, 1942.]

In addition to the fungi already reported for the first time as agents of pear decay in N. America [*R.A.M.*, xx, p. 347], the authors here enumerate *Alternaria mali*, *Aspergillus flavus*, undetermined species of *Cephalosporium*, *Gloeosporium*, *Helminthosporium*, *Hendersonia*, *Pullularia*, and *Stemphylium*, *Hormodendrum cladosporioides*, *Neofabraea malicorticis*, *Penicillium chrysitis*, *P. cyclopium*, *P. puberulum*, *P.* (?) *roquefortii*, *P. terrestre*, *Phoma exigua* [ibid., xviii, p. 316], *Phomopsis* [*Diaporthe*] *ambigua* [ibid., xvi, p. 105], *Pleospora fructicola*, and *Sporotrichum malorum* [ibid., xx, p. 476] as new records for the same continent, while other fungi isolated from pears in Washington included *Cephalothecium* [*Trichothecium*] *roseum*, *Sclerotinia fructicola*, *Mucor piriformis*, *Phoma mali* [ibid., xvii, p. 466], and *Phytophthora cactorum*. At laboratory temperature the most actively parasitic isolates, in decreasing order of the rate of decay, were *Rhizopus nigricans*, *P. cactorum*, *S. fructicola*, *Botrytis cinerea*, a sterile fungus, *M. piriformis*, *D. ambigua*, *Alternaria mali* strain 4, *Aspergillus pyri*, *Helminthosporium* sp., *Penicillium expansum*, and *P. terrestre*. Common storage temperatures (40° to 54° F.) inhibited the parasitism of all but one of the isolates, while under cold storage conditions (32° to 35°) *Phytophthora cactorum*, *R. nigricans*, *A.* spp., *H.* sp., *Penicillium tardum*, *Stemphylium* No. 2, and a sterile fungus, proved incapable of causing decay, though *M. piriformis*, *Phoma mali*, *B. cinerea*, and *P. expansum* were comparatively active.

Huber (G. A.) & Baur (K.). **Apothecia of Sclerotinia fructicola on Peach in Western Washington.**—*Phytopathology*, xxxii, 7, pp. 635–636, 1 fig., 1942.

*Sclerotinia fructicola*, which causes considerable fruit decay of peach in Western Washington during the harvest period, may overwinter in mummies attached to trees and produce a fresh crop of moniliospores in the following spring [*R.A.M.*, xxi, p. 27]. On 26th March, 1941, apothecia were observed for the first time developing

from peach mummies below a single tree in an orchard in Clark County, the cultural characters of isolates from which resembled those of strains of *S. fructicola* from Italian prune mummies. Both prunes and peaches reacted positively to inoculation with pure cultures of the organism.

English (H.) & Gerhardt (F.). **Effect of carbon dioxide and temperature on the decay of Sweet Cherries under simulated transit conditions.**—*Proc. Amer. Soc. hort. Sci.*, xl, pp. 172–176, 1 graph, 1942.

Sweet cherries (variety Bing) inoculated with water suspensions of cultures of the brown rot fungus *Sclerotinia fructicola* [*R.A.M.*, xxi, p. 27] and of the blue mould fungus *Penicillium expansum* were stored in the summer of 1941 in atmospheres of carbon dioxide at concentrations of 5, 10, or 20 per cent. and at varying temperatures for either five or nine days, and examined either immediately after removal from storage or after two additional days in air at 65° F. Fruits kept at 31° in air without the addition of carbon dioxide developed no decay after either period of storage, indicating the possibility of controlling decay of cherries in refrigerator cars without using carbon dioxide by maintaining this temperature. At a storage temperature of 36°, no decay by either fungus developed either in air storage or in carbon dioxide after five days, nor was any *S. fructicola* present in any of the lots after nine; the 59 per cent. decay by *P. expansum* that developed in air storage after nine days at that temperature was reduced to 6·5 per cent. by 5 per cent. carbon dioxide and completely controlled by 10 per cent. At a storage temperature of 45°, *S. fructicola* was entirely absent from all lots after five days, and although present in air storage (40·2 per cent. decay) after nine, was completely controlled by the 20 per cent. concentration of the gas; *P. expansum*, present in air storage (72 per cent. decay) after five days was controlled by a 10 per cent. concentration of carbon dioxide, but after nine days the highest concentration of the gas reduced the amount of decay (to 4·1 from 85·6 per cent. in air storage) without completely controlling it. All lots examined after two additional days in the air at 65° were infected, although those kept in carbon dioxide developed less decay than those stored in air at the same temperature. Data for uninoculated cherries stored under the same conditions showed no significant amount of decay in any of the lots after five days, or even when examined after two additional days in the air at 65°; stored for nine days and examined after two additional days in the air, the lots held in air had two to three times as much decay as those in 20 per cent. carbon dioxide at either 36° or 45°. The fungi isolated from the lesions on these cherries, in descending order of incidence, were *Botrytis* sp., *Cladosporium* sp., *Pullularia* sp., *Hormodendrum* sp., *Stemphylium* sp., *Penicillium* sp., and *Mucor* sp. It is concluded from the results of these studies that brown rot and other kinds of decay can be effectively controlled by carbon dioxide at concentrations within the range used in commercial shipping. This conclusion is also supported by records taken of unspecified decay in cherries developing during transit and by data supplied by shippers of cherries from California.

Zeller (S. M.) & Milbrath (J. A.). **Banded chlorosis, a transmissible disease of Cherry.**—*Phytopathology*, xxxii, 7, pp. 634–635, 1 fig., 1942.

Japanese cherries (*Prunus serrulata*) of the Amanogawa, Okochin, and Temari varieties in Oregon were observed in 1940 to be affected by a disease termed 'banded chlorosis' (*Marmor pallidolimbatus* or *Prunus* virus 10), the outstanding feature of which was the development on the leaf surface of discoloured areas surrounded by a chlorotic band, 1 to 2 mm. broad, sometimes describing a circle and forming ring spots, singly or in chains, usually between two lateral pinnate veins or along the margin, while in other cases more or less perfect 'oak leaf' patterns extend from the midvein to points on the lateral ones, or, again, only a sector between the margin and the midrib may be involved. The chlorotic areas are whitish or yellowish, sometimes

becoming pinkish. Amanogawa trees of 16 years old or more also suffered from a die-back of the twigs, which may not, however, be directly caused by the virus. Numerous cases of bud perpetuation of the disease were observed in nurseries, and the disorder was successfully transmitted by means of Amanogawa buds to nine out of ten healthy mazzard seedlings.

Plakidas (A. G.). **Spray tests for the control of Strawberry leaf spot caused by Mycosphaerella fragariae.**—*Rep. La Fruit Exp. Sta., 1939–40*, pp. 25–28, 1941. [Abs. in *Chem. Abstr.*, xxxvi, 13, p. 3898, 1942.]

Excellent control of strawberry leaf spot (*Mycosphaerella fragariae*) was secured at Hammond, Louisiana, by spraying with standard Bordeaux 4–4–50 or 'spraycrop' (containing 34 per cent. copper and no free lime). Slight foliar injury resulted from the use of Bordeaux mixture, whereas 'spraycrop' caused no damage.

Berkeley (G. H.) & Plakidas (A. G.). **Strawberry leaf roll, a new disease.**—*Phytopathology*, xxxii, 7, pp. 631–633, 1 fig., 1942.

In June, 1938, at St. Catharines, Ontario, and in September, 1940, at Geneva, New York, strawberry plants (Premier variety in the former and U.S.D.A. No. 1631 and Geneva No. 9270 seedlings in the latter locality) were observed to present a delicate appearance and to be affected by a downward rolling of the leaflets, which in extreme cases assumed the form of a funnel-shaped tube. The leaves of the diseased plants were pale green, smaller and narrower than the normal, the petioles being unusually long and spindly. The leaf blades were ruffled, rugose, and bore irregular, chlorotic areas of variable size. Grafting experiments with runners were successful in a few cases, including one involving the transmission of the pathological conditions to a clone of *Fragaria virginiana* and its two daughter plants. The disorder, termed leaf roll, is attributed to a hitherto unrecorded virus.

Snell (W. H.). **The production of sporidia of Cronartium ribicola on cultivated Red Currants in relation to infection of White Pine.**—*Amer. J. Bot.*, xxix, 7, pp. 506–513, 1942.

Considerable data upon the number of leaves, total leaf area, and number of teleutosori and sporidia of *Cronartium ribicola* per bush for cultivated red currants, cultivated European black currants, and wild gooseberries (*Ribes cynosbati* and *R. rotundifolium*) [*R.A.M.*, xxi, p. 29] showed that even under maximum infection conditions, a garden row of red currants produces only a fraction of the number of sporidia produced by wild gooseberries and an even smaller fraction of the number produced by black currants. Factors reducing the total sporidium production on red currants are (1) the small number of bushes that become infected, (2) the high resistance of mature leaves, (3) the tendency to produce a single set of leaves in a season, (4) the lowered viability of the teleutospores and sporidia produced, (5) early defoliation, (6) necrosis of blister-rust spots, and (7) the reduced size of the teleutosori.

By the use of the 'threshold' or 'quantum' principle (which derives a certain theoretical volume of sporidia for the production of a single canker on pine) it is demonstrated that the maximum sporidium production by red currants in New York State is close to or even under the lowest limits necessary for the infection of pine.

The results indicate that red currants offer little if any danger of infection by *C. ribicola* to white pine; the necessity of applying the 900 ft. eradication zone to them in gardens [loc. cit.] remains to be proved.

Wardlaw (C. W.). **Banana research at the Imperial College of Tropical Agriculture, B.W.I.**—*J. R. Soc. Arts*, xc, 4621, pp. 644–653, 1942.

In this address to the Royal Society of Arts, London, delivered on 4th February,

1942, the author briefly reviews in popular terms research work carried out in Trinidad since 1928 on Panama disease of bananas (*Fusarium oxysporum* [var.] *cubense*) [*R.A.M.*, xxi, pp. 241, 340], with special reference to breeding for resistance and to storage investigations. He states that the hybrid I.C. 2, after showing a degree of resistance almost amounting to immunity over a number of years at the Imperial College, suddenly, when transplanted to two other localities in Trinidad, manifested complete susceptibility. Planting material of this hybrid sent to Jamaica also proved subject to infection. No reason appears to have been adduced for this behaviour, but it is thought that bud mutation may possibly be involved.

**Report on the Department of Agriculture, St. Lucia, 1941.**—12 pp., 1942.

On p. 10 of this report it is mentioned that the incidence of Panama disease of bananas (*Fusarium* [*oxysporum* var.] *cubense*) revealed by the 1941 survey amounted to 5·41 per cent., an increase of 1·40 per cent. over the previous year (cf. *R.A.M.*, xix, p. 717), the percentages of infected plants in gardens under and over three years old being 2·98 and 5·95 per cent., respectively.

PONTIS (R. E.) & HANSEN (H. N.). **Olive anthracnose in the United States.**—*Phytopathology*, xxxii, 7, pp. 642–644, 1 fig., 1942.

Mission olive fruits at the University of California, Berkeley, were observed in December, 1941, to bear the typical brown, irregular, depressed lesions, later turning brick-red or black, of the anthracnose fungus, *Gloeosporium olivarum* [*R.A.M.*, xxi, p. 403]. In Portugal and Greece [ibid., xiii, p. 789] the disease is responsible for considerable damage, and there are indications that it may also assume a severe form in California. The organism exhibited the so-called 'dual phenomenon' [ibid., xvii, p. 830] in monospore cultures on potato dextrose agar, one type producing an abundance of mycelium and few conidia, while in the other the position was reversed. Both mycelial and conidial types of the fungus were about equally pathogenic to injured olive fruits, the symptoms appearing after 36 hours and acervuli developing a week later. This is believed to be the first record of *G. olivarum* in the United States.

CHACE (W. G.) & URLAUB (G. S.). **A new culture medium for the growth of Chaetomium globosum.**—*Amer. Dyest. Reptr*, xxxi, 14, pp. 331–333, 3 figs., 1942.

The following cellulose agar medium was found at the Lowell Textile Institute to be superior to Czapek's agar for the development of *Chaetomium globosum*, large quantities of the spores of which are required for the testing of mildew-proofed fabrics [*R.A.M.*, xxi, p. 288]: 1,000 ml. water (tap or distilled with a trace of ferric sulphate), 3 gm. sodium nitrate, 1 gm. potassium dihydrogen phosphate (buffering the substratum at $P_H$ 5·0), 25 gm. magnesium sulphate, 0·25 gm. potassium chloride, 15 gm. agar, and 10 gm. filter paper. The use of this medium reduces the time needed for sporulation to four or five days, permits the production of spore quantities many times exceeding those obtainable on Czapek's agar, and virtually eliminates the common air-borne contaminants.

HERRICK (J. A.). **A simple technique for aseptic handling of media.**—*Phytopathology*, xxxii, 7, pp. 636–637, 1942.

The technique successfully developed by the writer at the Kent (Ohio) State University for the aseptic manipulation of liquid culture media consists essentially in the use of a transfer chamber 20 by 30 by 30 in., the walls and ceiling of which are formed by pieces of cheese-cloth soaked in 3 per cent. lysol solution. When all sterilized equipment, media, etc., have been placed in the chamber, the air is thoroughly sprayed with a disinfectant solution, and other precautions [which are indicated] taken for the exclusion of external contamination. The technique may be of value where equipment is very limited or more elaborate apparatus impracticable to use.

Hansen (H. N.). **Heterocaryosis and variability.**—*Phytopathology*, xxxii, 7, pp. 639–640, 1942.

Having observed that several mycologists are under a misapprehension as to the relationship between heterocaryosis and variability in fungi [*R.A.M.*, xvii, p. 830], the writer briefly discusses the nature and origin of heterocaryosis and its connexion with the development of mutants. He points out that the term heterocaryosis precisely describes the condition of a cell containing two or more genetically different nuclei. This condition is induced either by mutation within a plurinucleate entity or by fusion or anastomosis between cells having genetically unlike nuclei. When fungi in the heterocaryotic condition are isolated and cultured they may give the impression of great variability by producing tufts, patches, or sectors differing from the main growth. Heterocaryosis may therefore appear to induce variability, but in reality the basic cause of variability and the primary cause of heterocaryosis is mutation.

Haselhoff (E.). **Die landwirtschaftlichen Versuchsstationen als Werkstätten der agrikulturchemischen Forschung.** [The agricultural experiment stations as laboratories of agricultural-chemical research.]—107 pp., Berlin, Gebr. Bornträger, 1941. [Abs. in *Z. PflKrankh.*, lii, 6, pp. 316–317, 1942.]

This account of the functions of the German agricultural experiment stations, dealing primarily with their work in connexion with soil science and plant and animal nutrition, contains a short chapter on plant diseases. Before 1906, when the plant protection service was reorganized by the Biological Institute, phytopathological problems were investigated by the experiment stations, and since that date some of the stations have continued to co-operate with the Biological Institute along both scientific and practical lines. Uniformity in the organization and procedure of the plant protection service was only attained under the provisions of the law of 5th March, 1937 [*R.A.M.*, xvi, p. 640], governing the care of economic plants.

Ocfemia (G. O.). **Geographical distribution of virus diseases of plants with special reference to the Philippines.**—*Proc. sixth Pacif. Sci. Congr.*, iv, pp. 745–748, 1939 (1940). [Abs. in *Biol. Abstr.*, xvi, 6, p. 1456, 1942.]

The author discusses the geographical distribution and the transmission of Fiji disease and mosaic of sugar-cane, the bunchy top diseases of banana and abacá [*Musa textilis*], and infectious chlorosis of bananas, which may be identical with the the abacá bunchy top. Sugar-cane sereh disease and streak and rice stunt have not yet been found in the Philippines.

Valleau (W. D.). **Virus nomenclature and classification.**—*Chron. bot.*, vii, 4, pp. 152–154, 1942.

The author opposes Bawden's suggestion (*Chron. bot.*, vi, pp. 385–386) to adopt a catalogue of approved names of viruses and any attempt at a preliminary general scheme of virus classification [*R.A.M.*, xxi, p. 343]. He proposes that as soon as viruses affecting certain groups of plants have been sufficiently studied to demonstrate their relationships to one another and to some of the well-known viruses, they be assigned binomials which would either place them in recognized genera, or, if evidence warranted, in newly established ones; for those not sufficiently studied, the generic name *Marmor* might be used.

Macrae (Ruth). **Interfertility studies and inheritance of luminosity in Panus stypticus.**—*Canad. J. Res.*, Sect. C, xx, 8, pp. 411–434, 21 figs., 1 diag., 1942.

All five collections of *Panus stypticus* [*R.A.M.*, xiv, p. 270] from Europe examined in this study were found to be non-luminous, while all ten from North America were luminous. Series of pairings in all possible combinations of monosporous mycelia

from single sporophores showed that both forms of the fungus are heterothallic and tetrapolar. With three exceptions, complete fertility existed between monosporous mycelia of all the collections paired. The diploid mycelium and hybrid fruit bodies in the $F_1$ generation from a cross between the luminous and non-luminous forms were luminous and the haploid mycelia separable into two approximately equal luminous and non-luminous groups, indicating that luminosity in this species is an inherited character governed by a single pair of Mendelian factors, luminosity being dominant over non-luminosity, and that luminosity factors form all possible combinations with the interfertility factors.

DUFRÉNOY (J.) & REED (H. S.). **Coacervates in physical and biological systems.**—*Phytopathology*, xxxii, 7, pp. 568–579, 6 figs., 1942.

In further studies at the University of California, Berkeley, on the vacuolar inclusions found in the cells of plants suffering from various pathological conditions, e.g., mottle leaf (zinc deficiency) in orange [*R.A.M.*, xiv, p. 628] and zinc and boron deficiency in sunflower [ibid., xix, p. 727], attention was directed to the roots and buds as well as to the foliage. 'Coacervates', the term propounded by De Jong and Kruyt to describe the bodies rich in colloids immersed in a liquid relatively poorer in colloids, were observed in the vacuoles of all the organs examined in the case of plants grown in solutions lacking one or more of the essential supplementary trace elements. The morphology, distribution, and staining reactions of the coacervates are fully described. The inclusions appear to consist of a central mass of phenols or polyphenols surrounded by a layer of phospholipoid material, formed as a sequel to the disturbance of hydrogen bonds in the catechol-water system by the activity of a catechol oxidase.

HANSEN (H. P.). **Om Nomenklatur for Plantevira samt nogle Synonymer for Kartoffelvira og Kartoffelviroser.** [Nomenclature of plant viruses and synonyms of Potato viruses and Potato virus diseases].—*Tidsskr. Planteavl*, xlvi, pp. 363–373, 1941. [Abs. in *Chron. bot.*, vii, 4, pp. 172–173, 1942; and in *Biol. Abstr.*, xvi, 7, p. 1654, 1942.]

In this paper synonyms for the European potato viruses are listed and Danish names given for potato virus diseases arranged according to symptoms [*R.A.M.*, xvii, p. 338].

CALDWELL (J.). **The production of virus-free Potatoes in the south-west of England.**—*Ann. appl. Biol.*, xxix, 3, pp. 265–267, 1942.

A preliminary survey in the autumn of 1936 showed that in isolated parts of Cornwall and Devon potatoes had been grown from seed saved on the same farm for many years. Many of the stocks were comparatively free from virus diseases, comparing favourably in this respect with crops from imported seed. It was apparent that certain localities in both counties were very suitable for the production of clean stocks of potatoes. Also, crops from local seed matured earlier than similar crops from Scots or Lincolnshire seed. Much of the area also conforms to the requirements for districts with low aphis counts; the climate is humid, and the wind velocity high.

Twelve places were selected for experiment, spread over the whole peninsula and conforming with the requirements for high wind and high humidity. The growers participating in the work were asked to grow the stocks provided for at least two years, at as great a distance as possible from other potatoes. The stocks selected were Sharpe's Express, Arran Pilot, May Queen, Duke of York, Dargill Early, and Arran Consul. Except for Dargill Early, a sample of each was grown at Exeter under controlled conditions to keep a check on the growth made. One lot of each of two varieties was sent to every grower before the end of 1936. In the spring of 1937, the author examined the plants and a few doubtful ones were removed and burnt. The entire crop was stored, the growers taking care that no aphids were present during

storage. During 1938 all the centres were visited by official inspectors and the health of the plants was carefully observed. At Exeter a comparison was made between the time of maturity of a crop from Devon-grown seed and one from imported Scots seed. An interval of about three weeks elapsed between the ripening of the two stocks, the plants from the seed grown locally being consistently ahead of those from the Scots-grown seed. One stock which became badly infected with virus disease was probably infected by aphids present in the store, and this may be an important factor in the spread of viruses in this area.

The evidence obtained showed clearly that large quantities of seed potatoes could readily be produced on Dartmoor, Bodmin Moor, and parts of Exmoor. In many other areas the conditions are also satisfactory, and a great part of west Devon and Cornwall would be suitable. In many areas this industry would provide a profitable use for land that is not at present successfully cultivated. Two precautions should, however, be taken: varieties must be grown in isolation, and the custom of permitting workers to grow a few rows of their own seed in the middle of a crop should cease.

Bonde (R.). **Ring rot in volunteer plants.**—*Amer. Potato J.* xix, 7, pp. 131–133, 1942.

Experimental evidence has been accumulated in Maine since 1934 to show that the causal organism of potato ring rot [*Corynebacterium sepedonicum*] does not survive the winter in the soil of fields carrying severely diseased crops in the previous season. It was, however, found to persist through the winter of 1940–1 in Katahdin tubers kept in trenches about 6 in. below the surface of the soil and covered to surface-level, part of each lot being further protected against cold with a shallow layer of weeds and potato tops. The incidence of survival of *C. sepedonicum* in the plants developing from the 65 to 82 per cent. of the tubers that withstood the winter ranged from 42 to 57 per cent., the higher figure occurring in the portion of a lot receiving no additional protection. Growers are therefore advised to plant their seed plots on fresh sites, and to make sure that any volunteer potato plants are destroyed.

Hastings (R. C.). **New developments on certifying seed Potatoes.**—*Amer. Potato J.*, xix, 7, pp. 149–152, 1942.

Potato ring rot [*Corynebacterium sepedonicum*] is stated to have multiplied the problems of seed certification [*R.A.M.*, xxi, p. 263], necessitating further field inspections in addition to the two normally required, with a consequent increase in cost to be borne ultimately by the growers. During the past season, one or more diseased plants were found in 5,000 of the 37,000 acres surveyed in North Dakota, and six or eight carloads were rejected in the south on account of ring rot.

Levitt (J.). **A histological study of hollow heart of Potatoes.**—*Amer. Potato J.*, xix, 7, pp. 134–143, 1942.

In a study at the North-Central (Grand Rapids) branch of the Minnesota Agricultural Experiment Station on hollow heart of potatoes [*R.A.M.*, xix, p. 645 and next abstract], 2,818 Irish Cobbler tubers planted on 15th May, [? 1941] were examined at successive harvests between 24th July and 17th September, and 65 were found to be suffering from the disorder, the incidence of which was four times as heavy in the first as in the last crop, contradicting the popular belief that the trouble does not originate until late in the growing season. Fully developed hollows (up to or exceeding 10 by 20 mm.) were ordinarily observed only in large tubers and the incipient stages of the disease (necrotic patch surrounded by wound cambium or hollows up to 5 by 10 mm.) in small ones.

The first sign of hollow heart was a group of several dead, brown cells in the pith, some still occupied by starch grains. Surrounding the dead cells were several rows practically devoid of starch, in which some cell division had already taken place. At a later stage, the group of dead cells was partially or completely encircled by a

cambium layer of several rows. The next phase was characterized by the formation of a small cavity, almost entirely surrounded by a row of dead, brown, collapsed cells of unrecognizable structure, ruptured in places, and in turn encircled by several rows of living cambium cells and an outer radius of relatively starch-free cells. With the further advance of the disease the cavity became larger and somewhat more elongated in the short axis of the tuber, but even at this stage the wound cambium cells were disposed in distinct radial columns, showing that only periclinal divisions were involved. Neither the dead cell layer nor the wound cambium layer completely encircled the cavity, into which, however, some elongated or spherical cells protruded, and when the hollow had attained its full size almost the whole surface was lined with living tylosis-like cells, which were sausage- or flask-shaped or spherical and frequently larger than the adjacent tissue cells. In the mature tubers the middle lamella of the cells surrounding the wound was suberized, judging by its reaction to Sudan III stain, yet the cells were still living, according to their response to vital staining with neutral red, plasmolysis, and streaming movement.

These observations show that the hollow-heart cavity is not of lysigenous origin, since no cell disintegration or absorption occurs, nor is it the simple type of schizogenous hollow arising from the separation of living cells at the middle lamella and resulting in a giant intercellular space. Its formation is preceded by the death of a patch of cells and the development round them of a wound cambium.

The rough correlation between tuber size and the dimensions of the hollow cavity agrees with the assumption that hollow heart is a growth phenomenon, both the extent and shape of which are explicable by a non-uniform development of the tuber outside the necrotic region, so that the periphery expands more rapidly than the centre. The supposition was confirmed by cell measurements on diseased Russets.

In view of certain analogies between the hollow-heart condition of potatoes and that of apples suffering from boron deficiency [ibid., xix, p. 353], spectrographic analyses were made of six mineral constituents (potash, copper, magnesium, iron, manganese, and calcium) in diseased (average weight 145 gm.) and sound tubers (118 gm.), and all were found to occur in significantly smaller quantities in the former than in the latter.

Cordner (H. B.). **A study of problems relating to production of fall-crop Irish Potatoes in Oklahoma.**—*Bull. Okla. agric. Exp. Sta.* B—258, 59 pp., 4 figs., 11 graphs, 1942.

A detailed, fully tabulated report is given of investigations which have been in progress at the Oklahoma Agricultural Experiment Station since 1937 to determine the causes of failure of the autumn potato crop obtained from spring crop tubers planted in July and August. The following are among the conclusions drawn. High soil temperatures, e.g., between 90° and 95° F., were found to be responsible for severe damage to potato seed, a mean of 90° at planting time resulting in a substantial reduction of stand. This form of high temperature breakdown presents analogies with black heart [*R.A.M.*, xxi, p. 302], the condition in both cases arising from physiological sources and being associated with a high respiratory rate and oxygen deficiency in the tuber tissues. The use of freshly cut seed pieces at the critical period for high soil temperatures was found to afford valuable protection against the trouble under observation, possibly by permitting an increased supply of oxygen to the interior tissues, at any rate for the first week or two after planting when the demand is greatest. At this time, too, sprouting may be initiated, and the sprouted seed is less subject to high-temperature breakdown; cut sets sprout more promptly than whole tubers—an additional reason for their use under the conditions indicated. Storage of the spring crop seed tubers at 50° was found to be inferior to a temperature of 75° to 80° for this purpose, the chilled sets sprouting less rapidly in the field than those stimulated by the warmth.

THIRUMALACHAR (M. J.). **Puccinia droogensis Butler on Berberis aristata D.C.**—*Curr. Sci.*, xi, 7, pp. 282–283, 7 figs., 1942.

A description is given of *Puccinia droogensis* Butl. (*Indian For.*, xxxi, p. 670, 1905) collected on *Berberis aristata* at Kodaikanal, Madras, in 1940. The single distinct germ pore in each teleutospore of the rust clearly differentiates it from the species of *Cumminsiella* recorded on other *B.* spp. by Arthur [*R.A.M.*, xiii, p. 185]. *P. droogensis* is autoecious, and its aecidial stage differs from that of *Aecidium montanum* Butl. on *B. aristata*, *B. lycium*, and *B. coriaria* both in the absence of the witches' brooms produced by the latter rust and in spore dimensions (17 to 35 by 17 to 29 $\mu$, average 19 by 23 $\mu$ in *A. montanum* as against 18 to 22 by 16·4 to 18 $\mu$ in *P. droogensis*).

BISBY (G. R.). **Mycological nomenclature.**—*Phytopathology*, xxxii, 7, pp. 644–645, 1942.

The author proposes two changes involving Articles 4 and 57 in the International Rules of Botanical Nomenclature, viz., (1) the legalization of the conservation of specific names which have become firmly established in the literature through many years' extensive usage; and (2) the designation of Ascomycetes and Basidiomycetes (not Phycomycetes) with pleomorphic life-cycles by the first valid binary name applied to the perfect stage, though the name of the imperfect stage may be retained in cases where ambiguity might arise from its discontinuance. In connexion with (1) it is pointed out that the specific epithets in the names *Tilletia tritici*, *T. levis*, *Ustilago levis*, and *Rhizopus nigricans*, though disallowed by the existing rules, will continue to be used, as also will about a score of pre-Friesian names of powdery mildews recognized by Salmon and all subsequent workers; while as regards (2) the retention of *Cladosporium herbarum* should be permitted, notwithstanding the discovery and verification of its perfect stage, *Sphaerella tulasnei*, at any rate in countries where only the former phase is known.

HENDERSON (R. G.). **Breeding Tobacco for black-root resistance.**—Abs. in *Phytopathology*, xxxii, 7, p. 647, 1942.

In the course of eight years' work on the breeding of tobacco for resistance to black root rot (*Thielaviopsis basicola*) in Virginia, crosses have been made between a resistant variety of Turkish (Xanthia) and susceptible flue- and dark fire-cured strains. The $F_1$ progeny resembled the Turkish parent in being resistant to the fungus and most other characters, and selections from the $F_2$ and $F_3$ populations also proved highly resistant to *T. basicola*. In experiments on the back-crossing of the $F_2$ and later generations to the susceptible parent, a high level of resistance was maintained, especially from the $F_3$ onwards, but the leaves remained undesirably small, a second back-cross being required to produce full-sized foliage.

In 1941 several resistant hybrids of the flue-cured type were tested on soil infested with *T. basicola*, one of which, No. 38, combined resistance to black root rot with heavy cropping and a suitable growth habit. The growth of resistant hybrids proceeded at a uniform rate from their establishment in the field to the attainment of full height, whereas that of susceptible plants was retarded by root rot during the first two months of the vegetative period.

JOHNSON (J.) & FULTON (R. W.). **The broad ring-spot virus.**—*Phytopathology*, xxxii, 7, pp. 605–612, 2 figs., 1942.

A new virus observed in 1938 on some 30 per cent. of the plants in a tobacco crop nearing the topping stage in Wisconsin has been designated 'broad ring spot', inoculation with extracts of which on young Havana No. 38 plants produced on the leaves small, chlorotic rings, two or more such rings being often disposed concentrically, and puckering of the veins. The disease has not been observed in any

other field and not in the original field since 1938. It is therefore extremely rare. Systemic symptoms appear on two or three young leaves, the succeeding three or four of which may be apparently healthy and the next diseased. The infective principle was found to be present in the leaves showing no symptoms, which reacted negatively to inoculation with the broad ring-spot virus, but positively to the introduction of potato ring spot, ordinary tobacco ring spot, tobacco ring spot No. 2, or lucerne mosaic [*R.A.M.*, xv, p. 831; xix, p. 668]. During the early autumn and late spring, when greenhouse temperatures rise, the chlorotic type of spotting is partially replaced by fine, brown, necrotic circles, which were also characteristic of the disease in the field. John Baer tomatoes inoculated with broad ring spot developed well-marked chlorosis and necrotic rings, the latter being rather broader than those on tobacco and following the course of the veins to a greater extent; the leaflets showed considerable distortion.

The new virus is readily transmissible by mechanical inoculation, especially with the aid of carborundum, but apparently not by *Myzus persicae*. Its thermal death point is 54° C., its maximum longevity *in vitro* 42 hours, and its dilution end-point just above 1 in 1,000. It does not appear to be filterable by ordinary methods. Forty-one named plants belonging to 16 families were successfully inoculated with the broad ring-spot virus. Most of these potential hosts developed a mild, vermiculate, chlorotic pattern, but on sunflower the virus produced chlorotic rings and on cucumber scattered, yellow spots, while the foliage of *N. glutinosa* and *N. sylvestris* was much distorted. Squash and potato were the only two plants on which infection remained localized.

Helson (G. A. H.). **The leaf hopper Thamnotettix argentata Evans, a vector of Tobacco yellow dwarf.**—*J. Coun. sci. industr. Res. Aust.*, xv, 2, pp. 175–184, 1 fig., 3 graphs, 1942.

All attempts to breed *Thamnotettix argentata* [*R.A.M.*, xx, p. 604], a vector of tobacco yellow dwarf, upon tobacco are stated to have failed. Many of the hosts on which the insect breeds are common weeds in tobacco fields or neighbouring pastures, and on these it produces three generations every year in northern Victoria.

Field observations in Victoria in 1940–1 showed that the insect bred on capeweed (*Cryptostemma calendulaceum*) and crowfoot (*Erodium* sp.) and increased considerably before the death of these weeds at the end of November. First-generation adults, which had then reached a peak of abundance and appeared to be carrying the virus, were forced on to the young tobacco crop for want of other food. Symptoms of the disease appeared about a fortnight later.

Valleau (W. D.), Johnson (E. M.), & Diachun (S.). **Association of Tobacco leafspot bacteria with roots of crop plants.**—*Science*, N.S., xcvi, 2485, p. 164, 1942.

The authors continued their investigations on tobacco wildfire (*Bacterium tabacum*) [*Pseudomonas tabaca*] and angular leaf spot (*Bact. angulatum*) [*P. angulata*], with particular reference to the source of inoculum in tobacco plant-beds [*R.A.M.*, xxi, pp. 308, 431]. Roots of cover crops, including wheat, barley, rye, crimson clover [*Trifolium incarnatum*], and vetch from artificially contaminated soils out-of-doors and from fields where the diseases had been severe in 1941 were washed free from soil in running water, and ground in a mortar. When this material, diluted with water, was poured over the surface of artificially water-soaked tobacco leaves, severe infection frequently resulted. Tobacco roots from naturally infected beds also gave heavy infection when used in this way. *P. angulata* was also isolated from seedling tobacco roots before the disease appeared on the leaves in untreated beds, and from tobacco roots in beds treated with Bordeaux mixture. It is, therefore, not unlikely that both organisms may be carried from the plant-bed to the field on the roots of

healthy plants, and serve as a source of sudden outbreaks in the field after a long wet period.

Microscopic examination of tobacco rootlets from naturally infected plant-beds and artificially inoculated tobacco roots growing in sand showed the presence of masses of bacteria; pieces of roots bearing these colonies when used as inoculum produced heavy infection by either disease (depending on the source) on water-soaked tobacco leaves.

*P. tabaca* and *P. angulata* are able to maintain themselves on the roots of several unrelated crop plants for at least six months, and under certain natural conditions they are able to cause specific leaf spot diseases of several unrelated plants, such as tobacco, tomato, morning glory [? *Ipomoea* sp.], and cowpeas. In the opinion of the senior writer these bacteria are not primarily tobacco pathogens at all, but merely common (though specific) organisms present on roots, perhaps of native vegetation, and which under specially favourable circumstances cause specific leaf spots of tobacco.

Lyon (C. B.), Beeson (K. C.), & Barrentine (M.). **Macro-element nutrition of the Tomato plant as correlated with fruitfulness and occurrence of blossom end rot.**—*Bot. Gaz.*, ciii, 4, pp. 651–667, 11 figs., 1942.

When 1,044 plants of an inbred strain of Bonny Best tomatoes were grown in sand culture, and the effects of 87 different nutrient solutions varying in the relative proportions of macro-nutrient elements (equal amounts of boron, manganese, zinc, copper, and iron being supplied in each case) were studied statistically in relation to fruitfulness and the occurrence of blossom-end rot, it was found that variations in the amount of calcium and nitrate in the nutrient medium resulted in greater differences in fruitfulness over wider ranges in concentration than did the other elements. The greatest fruitfulness resulted in treatments high in nitrate and low in sulphate and phosphate in the anion triangle (for convenience the nutrient relations are represented in cation and anion triangles and treatment numbers assigned to those solutions used) and in treatments high in calcium and low in magnesium and potassium in the cation triangle. The percentage of rotted fruits on each plant increased as the calcium concentration of the medium decreased; this correlation was largely independent of the magnesium and potassium concentrations, and no correlation with any anion was found. Fruits from treatments inducing the most severe rotting were low in calcium and high in potassium and magnesium. The occurrence of blossom-end rot was clearly associated with calcium nutrition.

Hildebrand (E. M.). **A micrurgical study of crown gall infection in Tomato.**—*J. agric. Res.*, lxv, 1, p. 45–59, 7 figs., 1942.

In studies with the crown gall organism, *Phytomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xxi, p. 67], inoculation of Bonny Best tomato plants was carried out with the help of a micrurgical apparatus consisting of a double Chambers micromanipulator and accessories arranged for the isolation of bacteria under one microscope and their immediate inoculation into a plant under a second one. Single cells of the organism were found to grow and multiply readily in sterile juice extracts from young tomato plants; and also in the sap in wound cavities, isolation from wound tissue five days after inoculation with a single bacterial cell and before symptoms appeared yielding thousands of bacteria. Inoculation of single plant cells made by means of a micropipette, which caused wounds of only 3 $\mu$ and did not kill the plant cells, failed to induce gall formation, thus indicating that the interior of living cells is not a favourable medium for the survival of these bacteria. The smallest wounds in which infection occurred, involving one to several epidermal cells, were produced by gently stroking the stems and petioles of tomato plants with a smooth polished needle moistened in a suspension of *Bact. tumefaciens*, tiny galls developing within five days of inoculation. It was estimated that less than 5 per

cent. of plant cells injured became infected. When shallow stem wounds, about 0·1 mm. in diameter and from 2 to 12 cells deep, were inoculated with one or more bacterial cells, it appeared that the percentage of infection was somewhat higher and the galls larger when more than one bacterial cell was used and deeper wounds inoculated: single bacteria induced gall formation in about 10 per cent. of the plants, 2 to 10 bacterial cells in 15, and 50 to 100 bacterial cells in 21 per cent. of the plants. In tests with deep wounds piercing one-fourth, one-half, and the whole of the stem, the largest galls were again associated with the deepest wounds; single bacteria produced infection in from 10 to 60 per cent. of plants, 2 to 10 bacteria in from 20 to 90 per cent., and 50 to 100 bacteria in practically every case. It appeared that the largest galls resulted from inoculation of deep wounds irrespective of the number of bacteria used in the inoculum, indicating that the depth of the wound is a more important factor in producing infection than the number of bacteria used as inoculum. It is suggested in explanation of these results that a single bacterial cell has less likelihood of finding the proper location for multiplication in the wound cavity than have larger numbers, and that deeper wounds are more favourable for infection on account of larger amounts of wound sap present. Isolations from galls from all experiments showed that bacterial population is roughly proportional to gall size.

Hartman (J. D.) & Samson (R. W.). **Wheel injury to Tomatoes during spraying and dusting operations.**—*Proc. Amer. Soc. hort. Sci.*, xl, pp. 467–470, 1 fig., 1942.

Data from spraying and dusting experiments carried out during 1941 in Indiana, in which a tractor-drawn sprayer on rubber-tyred wheels and a duster on steel-rimmed wheels, both equipped with special vine shields in front of each wheel, were used, showed that the wheel damage inflicted on tomatoes during these operations resulted in an average reduction in yield of 5 per cent. on rows injured on one side only, and of 8 per cent. in rows injured on both sides. The degree of injury was approximately the same whether the spraying and dusting took place five times or twice during the season. On the basis of these data, the average reduction in yield is estimated as being 2·3, 1·8, 1·4, and 0·7 per cent. for 6, 8, 10, and 20-row sprayers, respectively.

Blood (L. H.). **Scientists seek Tomato varieties resistant to Verticillium wilt.**—*Fm Home Sci., Utah*, ii, 4, pp. 5, 8, 2 figs., 1941.

Wilt (*Verticillium albo-atrum*) [*R.A.M.*, xx, p. 345; xxi, p. 3] is the most devastating but least conspicuous disease of tomatoes in Utah, where it causes losses of over $100,000 to growers every year. Infected plants average 30 to 60 per cent. smaller yields than healthy ones of the same variety. The 1941 epidemic caused a reduction of over 50 per cent. in the crop on many acres in Davis and Weber Counties.

Oyler (Enid) & Read (W. H.). **A stem rot of Tomato caused by Didymella lycopersici.**—*Gdnrs' Chron.*, Ser. 3, cxii, 2910, p. 120, 3 figs. (2 on pp. 121, 122), 1942.

Tomato canker (*Didymella lycopersici*) [*R.A.M.*, xix, p. 500] is stated to have caused very serious losses in the Lea Valley area in 1906; it then became progressively less important, only occasional specimens being received at Cheshunt between 1918 and 1940, until 1941, when a severe outbreak occurred in one nursery. Steam sterilization of the soil in which the affected crop had grown was resorted to, but the year following the disease reappeared, specimens also being received from nine other counties.

Under commercial conditions, infection does not occur until after the plants have been put into the houses. 'Soft' plants readily become attacked, while 'hard' ones are to a large extent resistant. Preliminary experiments demonstrated that in unwounded plants infection occurs most readily just above soil-level. If the stem is wounded, infection takes place most rapidly at the site of the wound. Secondary infection is found on unwounded stems, but is more usual where they have been wounded by the removal of side shoots and leafing, and where they have been bruised

by the strings. It may also occur at the exposed end of the peduncle after the fruits have been picked.

The fungus can overwinter in the soil, on canes, wires, old strings, and the superstructure of tomato houses.

While only a small proportion of tomato plants propagated or planted out in contaminated soil normally contract stem rot, destruction of the fungus in the soil is necessary, as the disease will make rapid spread through spore dissemination from plants which have become infected directly from the soil. Soil that has been sterilized, however, especially by heat, induces the type of growth most susceptible to attack, and attention should be given to ensure that the cultural conditions are such as to counteract this increased susceptibility.

Applications of petroleum oil emulsions (used as insecticides) and of petroleum oil-copper fungicides greatly increased susceptibility to attack.

Borzini (G.). **Sull' orientamento attuale nella lotta contro le malattie crittogamiche delle piante.** [On present tendencies in the control of fungal diseases of plants.] —*Ital. agric.*, lxxix, 3, pp. 163–166, 1942.

In the course of this discussion of attempts now being made in Italy to evolve satisfactory fungicides containing little or no copper, the author mentions that Petri has succeeded in developing strains of the S. Marzano tomato variety that are absolutely resistant to wilt (*Fusarium* [*bulbigenum* var.] *lycopersici*) [*R.A.M.*, xxi, p. 127]. The disease is stated to cause serious losses in southern Italy [cf. ibid., xiii, p. 562].

Porte (W. S.) & Wellman (F. L.). **Development of interspecific Tomato hybrids of horticultural value and highly resistant to Fusarium wilt.**—*Circ. U.S. Dep. Agric.* 584, 18 pp., 5 figs., 1941.

The available commercial varieties of tomato resistant to wilt (*Fusarium bulbigenum* var. *lycopersici*) [*R.A.M.*, xx, p. 607; xxi, p. 393] have proved susceptible under certain conditions. An attempt has therefore been made to produce high-quality, high-yielding tomato varieties more resistant to wilt than any so far developed in the United States. Among 145 foreign and 209 domestic lots of seed collected in 1932 a single sample (P.I. 79532) of *Lycopersicum pimpinellifolium* from Peru was found to be highly resistant to wilt both in field tests [ibid., xx, p. 91] and in rigorous greenhouse trials [ibid., xix, p. 170]. Through hybridization, back-crossing, and selection [details of which are given], many of the valuable horticultural qualities of the best resistant Marglobe lines have been combined with the high resistance of various lines of *L. pimpinellifolium*, resulting in the production of horticulturally acceptable, highly wilt-resistant tomatoes. Three of such selections, U.S. 7 W, U.S. 16 W, and U.S. 23 W (all back-cross selections from *Marglobe*×*L. pimpinellifolium*) showed in greenhouse tests a wilt-resistance index of 93·3, 94·6, and 94·7, respectively, compared with 7·8 for the Marglobe parent, 97·5 for *L. pimpinellifolium*, and 1·8 for the Bonny Best control. Under the severe conditions of the test the commercial wilt-resistant varieties were scarcely distinguishable from the very susceptible check. Bulk seed of the above-mentioned selections is not yet available, but small samples have been sent to a number of State Experiment Stations for further selection and development.

Bier (J. E.). **Forest pathology in British Columbia.**—*Pulp Pap.* (*Mag.*) *Can.*, xliii, 7, pp. 528, 530, 1942.

Broadly speaking, the whole field of forest pathology falls into two parts, one comprising the diseases caused by native organisms and the other those due to agencies of external origin [cf. *R.A.M.*, xxi, p. 275], the latter frequently assuming a much more virulent form in their new than in their indigenous habitat. An instance of this type is the white pine blister rust [*Cronartium ribicola*], first detected at Vancouver in 1921 and now threatening its host throughout the entire western range.

The reason for this access of 'aggressiveness' in the new territory is that the resistance acquired by a particular host through generations of exposure to a given parasite in one region is completely lacking in the same plant in another. Other diseases of recent introduction into British Columbia are chestnut blight [*Endothia parasitica*] (the host is of no importance locally) and willow blight [*Physalospora miyabeana* and *Fusicladium saliciperdum*] [ibid., xxi, p. 172], the latter having first been observed in Nova Scotia in 1927, since when it has spread right through the Maritime Provinces and the New England States, killing all susceptible varieties.

The introduction into Canada of exotic trees for plant-breeding purposes is also not without its attendant risks, as shown by the canker [*Septoria musiva*: ibid., xviii, p. 770] affecting Russian and native hybrid poplars (balsam × cotton wood) [*Populus tacamahacca* and *P. balsamifera*] in the Prairie Provinces. The fungus, which is merely a minor leaf-spotting pathogen of native species, attacks the stems of exotic poplars and crosses, causing rapid destruction. All imported material and hybrids therefrom should thus be tested for a sufficient period before release for general distribution.

It is of interest to note that in Eastern Canada the presence of decay, e.g., heart rot of poplar [*Polyporus dryophilus* var. *vulpinus*] in Ontario, is of actual advantage to the timber industry as necessitating intensive surveys of the affected areas, in the course of which much more sound wood has been salvaged for merchantable logs than would be expected from the external appearance of the trees. In this connexion co-operation between foresters and pathologists is urged as a basis for the collection of valuable information on the severity and distribution of tree diseases [cf. ibid., xx, p. 435]. A case in point is afforded by the sporadic occurrence of *F*[*omes*] *annosus* in a recently cut stand of 85-year-old hemlock [*Tsuga* (?) *heterophylla*] and Douglas fir [*Pseudotsuga taxifolia*] near Stave Falls in the Fraser Valley, in which there was no outward indication of disease.

In British Columbia the attention of forest pathologists at the moment is largely focussed on problems relating to natural and artificial regeneration of young Douglas firs. Damping-off [? *Pythium* and *Rhizoctonia* spp.: ibid., xii, p. 405] is not serious in nurseries at present, but it is essential to secure its complete control before embarking on the proposed innovation of sowing stratified seed to secure more even stands than those resulting from the use of dry-stored or unstratified material. The short germination period required by the new method would tend to promote fungal infection under appropriate conditions, but an unfavourable atmosphere for the fungi concerned may be induced by sowing the seed on a $\frac{3}{4}$ in. layer of peat moss and covering with the same. The only disease of importance in immature stands of *P. taxifolia* on Vancouver Island and in the Fraser Valley is the root rot caused by *Poria weirii*, which affects 19 to 40 per cent. of the dominant and co-dominant trees in a plot, a branch and stem canker [? *Phomopsis lokoyae*] being confined to poor sites, while the widespread decay due to *Armillaria mellea* is not responsible for heavy mortality.

Two diseases of some significance at Green Timbers are a leaf and stem blight of oriental cedar and a stem disease of cascara [*Rhamnus purshiana*] caused by a species of rust with its alternate stage normally on oats and wild grasses [*Puccinia coronata*], though the tree race has been experimentally shown to be innocuous to oats.

**Regulations made under the Importation of Plants Regulation Ordinance, Nigeria, 1935 (No. 29 of 1935). No. 38 of 1942.**—1 p., 1942.

Under an Order coming into force on 1st May, 1942, to be construed together with the Importation of Plants Regulations, 1936 [*R.A.M.*, xvi, p. 79], and cited as the Swollen Shoot (Prohibition of Import) Regulations, 1942, the importation into Nigeria of cacao plants or seeds from the Gold Coast [ibid., xx, pp. 517, 544] except on behalf of the Agricultural Department is prohibited.

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